'68' MICRO JOURNAL

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VOLUME III ISSUE X • Devoted to the 68XX User • October 1981

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UniFLEX™

Multi-User

UniFLEX is the first full capability multi-user operating system available for microprocessors. Designed for the 6809 and 68000, it offers its users a very friendly computing environment. After a user 'logs-in' with his user name and password, any of the system programs may be run at will. One user may run the text editor while another runs BASIC and still another runs the C compiler. Each user operates in his own system environment, unaware of other user activity. The total number of users is only restricted by the resources and efficiency of the hardware in use.

Multi-Tasking

UniFLEX is a true multi-tasking operating system. Not only may several users run different programs, but one user may run several programs at a time. For example, a compilation of one file could be initiated while simultaneously making changes to another file using the text editor. New tasks are generated in the system by the 'fork' operation. Tasks may be run in the background or 'locked' in main memory to assist critical response times. Inter-task communication is also supported through the 'pipe' mechanism.

Support

The design of UniFLEX, with its hierarchical file system and device independent I/O, allows the creation of a variety of complex support programs. There is currently a wide variety of software available and under development. Included in this list is a Text Processing System for word processing functions, BASIC interpreter and precompiler for general programming and educational use, native C and Pascal compilers for more advanced programming, sort/merge for business applications, and a variety of debug packages. The standard system includes a text editor, assembler, and about forty utility programs. UniFLEX for 6809 is sold with a single CPU license and one years maintenance for $450.00. Additional yearly maintenance is available for $100.00. OEM licenses are also available.

FLEX™

UniFLEX is offered for the advanced microprocessor systems. FLEX, the industry standard for 6800 and 6809 systems, is offered for smaller, single user systems. A full line of FLEX support software and OEM licenses are also available.

technical systems consultants, inc.
Box 2570, West Lafayette, IN 47906
(317) 463-2502 Telex 276143

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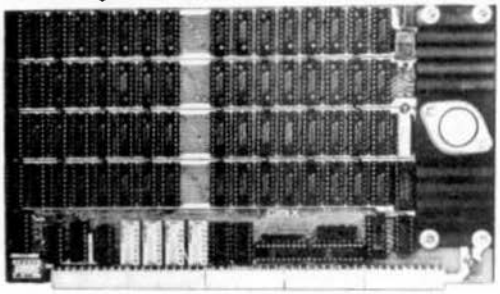

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NEW

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UniFLEX™

UniFLEX™ is now available for GIMIX™ SYSTEMS using the GIMIX™ 6809 CPU board and the GIMIX™ DMA disk controller with 8" drives.

see page 56 for more details on GIMIX™ disk controllers

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SEE GHOST AD PAGES 46-51-56

BASICØ9™ has a dual personality.

One craves meat-and-potatoes BASIC.

The other prefers Programme ala Pascal.

Some people say BASICØ9 is really a PASCAL in disguise, others say it's still BASIC. You'll understand this delightful dilemma when you look at both versions of the "bubble sort" program shown below: both can be run by BASICØ9. The program on top is unstructured and hard to understand, but it's traditional BASIC. The program on the bottom is well-structured and easy to follow, a virtue of PASCAL. With BASICØ9 you can program either way, or mix the best of both. It's like getting two languages for the price of one.

SORT AN ARRAY
IN ASCENDING SEQUENCE

```
90   DIM A(5)
100  I=5
110  IF I=1 THEN 200
120  FOR J=1 TO I-1
130  IF A(J)<=A(J+1) THEN 170
140  T=A(J+1)
150  A(J+1)=A(J)
160  A(J)=T
170  NEXT J
180  I=I-1
190  GOTO 110
200  RETURN
```

```
DIM array(5)
outer=5
WHILE outer>1 DO
  outer=outer-1
  FOR inner=1 TO outer
    IF array(inner)>=array(inner+1) THEN
      temp=array(inner+1)
      array(inner+1)=array(inner)
      array(inner)=temp
    ENDIF
  NEXT inner
ENDWHILE
RETURN
```

Makes programs better

BASICØ9 has five kinds of loop structures: WHILE . . DO, REPEAT . . UNTIL, LOOP . . ENDLOOP, FOR . . NEXT and IF . .THEN . . ELSE. If one of the five built-in data types (byte, integer, real, string, and boolean) doesn't suit the problem, you can make a new one of your liking with the TYPE statement. Need a tree, linked list, or symbol table? Complex non-rectangular data structures using any combination of data types are easy to define. Modular programming breaks down large programs to smaller, more manageable elements. BASICØ9 lets you create independent program modules called "procedures" with local variables for recursion plus parameter passing to any other BASICØ9 or machine language procedure. There is a complete set of statements for device-independent sequential or random I/O, plus a superlative PRINT USING system.

Makes programs faster

No full-feature BASIC for any 8-bit microprocessor is faster than BASICØ9, because it is an interactive compiler. As each program line is entered, it is instantly compiled to a smaller, faster form. Because BASICØ9 automatically converts programs back to original "source" form for listing, it is as friendly and easy-to-use as traditional interpreter BASICs. Each procedure can be independently compiled to position-independent, reentrant, ROMable format. Microware® developed a new ultra-fast 9-digit-accuracy floating point math system just for BASICØ9. And if that's still not fast enough, there's BYTE and INTEGER arithmetic.

Features that make programs easier to write

The compiler is integrated with a full-feature string AND line-number oriented text editor. If you make a mistake, BASICØ9 tells you instantly. String-oriented commands such as search, change, change all occurances, delete, and insert can be used on programs with or without line numbers. There's an automatic line renumbering function too.

Features that make programs easy to test

Debugging often takes longer than writing a program. That's why BASICØ9's integral high-level debugger sets it apart from all other compiled OR interpretive languages. The TRACE command shows you each statement executed in BASIC form, plus the result of any expression evaluation. STEP lets you run one or more statements at a time. LET and PRINT allow you to examine or change the values of variables, by name. STATE lists procedure calling order. And there are nine other debug commands. If you need to correct a program, you can edit, recompile, and rerun it in seconds.

Microware® software is available for most popular 6809 computer systems. Source listings and yearly maintenance update service are sold separately for most programs.

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Does timesharing on a small system make sense?

It does with OS-9™ Level One!

Now two (or more) acts can share your microcomputer stage. You will no longer have to walk away from your computer while it is busy running a long program. Because OS-9 is a multitasking operating system, you can be running a BASIC program while editing a PASCAL program, for example. This lets you make more efficient use of your time and your system, even if you only use one terminal. If your application requires multiple, independent terminals, one OS-9 system can do the work of several single-user systems.

The convenience of an advanced operating system

Sophistication does not require complexity. Many OS-9 users say that it is actually easier to use than the older 6800-type operating systems. Consider how easy it is to run multiple programs: to run a program you just type its name and hit 'return.' To run a program as a separate job, you type its name, an '&' character, then hit return. The program runs as usual, but OS-9 comes back immediately and is ready for your next command. Simple commands let you see each program's status, set its priority, or abort it.

The file management system has fast, byte-addressable random-and sequential-access files. The tree-structured multiple directory system lets you create separate disk directories for each user, project, or application. Command line I/O file redirection means you specify what device and/or files a program will use when you run it, not when you write it.

Efficiency and hardware versatility

No other operating system can run on such a broad range of hardware: the overall RAM requirement for Level One is 32K to 56K RAM. Memory utilization is superlative because OS-9 lets multiple tasks "share" the same reentrant program. For example, if two users run BASIC09, only one "copy" is actually loaded into memory. The Level Two version of OS-9 can utilize up to a megabyte of memory on systems having memory management hardware (both versions come with complete timesharing support).

OS-9's device independent I/O system can handle almost any number and combination of I/O devices: five or eight inch diskettes, winchester disks, disk cartridges, serial and parallel ports, memory-mapped video displays, and more.

Microware® offers a large selection of "stock" device interface software modules, or you can create your own: all the information you need is in the manuals.

Excellent support and documentation

Each OS-9 package comes with a User's Manual and a System Programmer's Manual that cover every aspect of OS-9. If you have special requirements, you can even purchase the Source Code for most of OS-9 and related software. At Microware® we take pride in offering the best customer support in the business. Technical advice and assistance by phone, mail or telex is available during all business hours.

Superb software tools

In addition to BASIC09, Microware® offers: an Interactive Assembler, Macro Text Editor, Stylograph Word Processor, Interactive Debugger, and coming soon, COBOL, PASCAL and C language compilers.

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COMING SOON
META—X—FORTH
Create romable code from X—FORTH for any processor!

OS-9 VERSION COMING

X FORTH FLEX COMPATIBLE FORTH

By Charles (Chuck) Eaker, Ph.D

X-FORTH NEWS

COMING SOON . . .
OSBORNE GENERAL LEDGER in X-FORTH for FLEX and OS-9

This is the same G/L program that you usually see in BASIC but with the speed advantage of X-FORTH and of course runs much faster than the BASIC version. It does NOT require X-FORTH to run.

META-X-FORTH

This package will take an X-FORTH program and compile it into object code for any processor. This means that you can use X-FORTH to create programs for other computers. The code produced is romable.

OS-9 FORTH

We are taking X-FORTH and putting it on OS-9. This will mean that programs written in X-FORTH will run on both FLEX and OS-9 with minimal changes.

X-FORTH NOTES

If you are considering buying FORTH, then you are probably trying to decide which one of the two that are available for the 68XX to choose. Well, perhaps I can help by telling you some of the more major differences between the two.

X-FORTH runs in the FLEX (or OS-9) environment just like BASIC or any other FLEX program. The files that it uses are the same as any other FLEX program. This makes it compatible with other programs or utilities that you may have. The other FORTH is not. (see Ron Anderson's columns)

X-FORTH at $149.95 is more or less the same package that you get for $250.00 for the other FORTH. That is $100.05 less.

X-FORTH is faster, about 25% faster, although, exact timing tests haven't been run yet. The reason X-FORTH is faster is because we coded many of the important things in assembler, not high level FORTH.

X-FORTH documentation is without a doubt the best that's available for any FORTH on any computer. The manual is divided into four major sections. The first section (approx. 100 pages) is a very good tutorial on FORTH in general and gives the first time user a feel for the system. The second section (approx. 60 pages) goes into the extensions that were added for FLEX. The third section, the users manual (approx. 130 pages) is the part you will use the most. Suppose you wanted to work with strings, all you do is look in the section on string operations for all the information you would need. Each section explains in easy to understand terms how each word works and how to use it. The last section is the glossary. (approx. 66 pages) All the words described in the users manual are listed alphabetically with complete descriptions.

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X-FORTH will be our major applications language in the future. Life is too short for BASIC. We are planning a complete business package in X-FORTH, A/R, G/L, A/P, etc. Because X-FORTH will run on many different operating systems, applications written in it will be much easier to maintain and of course the market is much bigger.

Well, I hope I've been able to answer many of your questions, but if you have more I'm just a phone call away.

Frank

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See Catalog on Page 9 for Ordering Information . . .

BY JIM SCHREIER

NEW

THE BILL PAYER SYSTEM ™

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Includes manual and source supplied on disk in TSC Extended Basic.

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You can create databases and do maintenance. Report writing is easy with both vertical and horizontal formats. Both 80 and 132 column reports are supported in the horizontal format. Formats are saved with run time options available. Label printing is made easy with up to 3 easily changed label drivers on line, and as with other DATAMAN output programs, the output can be spooled to disk for later printing. A statistics package gives up to 24 statistical values. You can transfer records from one database to another, blow away records, even merge two unlike databases together on a key. Sorting on up to 20 keys is done with a sort editor which uses the TSC Sort/Merge package. You can even build *PR* files for use with the TSC Text Processor for form letters, invoices, reports, etc. The list of features goes on and on!

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SEPT 81

NEW

By Dick Bartholomew

BASIC PROGRAMMERS TOOLKIT

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$69.95 with source on DISK!

1... DECOMPIL — Turns .BAC into .BAS files.
2... XREF — Cross reference listing of BASIC programs.
3... EDIT — Edit a BASIC program that's in memory while in BASIC!!!!!

NOTE: For TSC XBASIC only.

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7. INIT memory set command
8. SAVETEXT to disk
9. READTEXT from disk
10. REDIRECT change control port
11. REPLACE prompt memory change
12. MIRROR BACKUP fast sector copy

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Six programs that allow you to protect your system by preventing a bootup without the proper password.

— Warning —

PASSWORD can be overcome if the user has access to another disk without password protection that will boot FLEX.

Programs are written in 6809 assembly language.

See Catalog on Page 9 for Ordering Information . . .

NEW

Exclusively from FRANK HOGG

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by DIGITECH

We are pleased to announce a time/cost study program written with the *legal profession in mind. It will allow the attorney to keep accurate records of time and costs on a case/client basis. Reports can be generated at any time for any or all clients. Reports list the following: Client name and address, case numbers, entry dates, type of service, time, cost, check number, status (open, billed, paid), time/cost subtotal by the case, time/cost totals. Full editing for clients and/or cases.

System requirements are:
6809 computer with 56K, FLEX, XBASIC, DUAL 8" double sided/double density disk, and a smart terminal.
Price $400.00 includes 8" disk with compiled basic programs and manual. (source not available)
*The program can be modified for any time/cost type study.
Contact Frank Hogg.

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Payroll Program in XBASIC by DIGITECH

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- ... Handles hourly or salaried wages.
- ... Prints checks and W2 forms.
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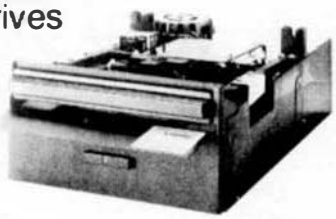

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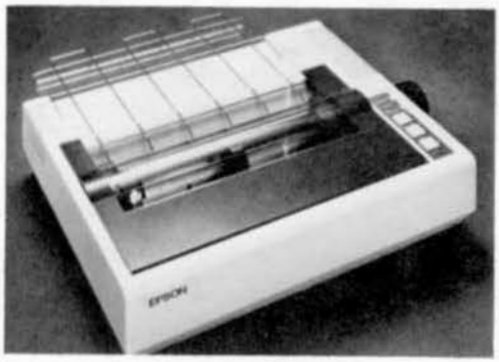

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PRIMEST OF ALL PRIME PROGRAMS

In case you missed the July '68', there was a program by Brian Bailey to calculate the primes to 10000, written in 6809 Assembler and using the Sieve of Erastosthenes method. It finds the primes in 2 seconds flat, and then outputs them to your terminal. Comparing that with my previous results using a divide for a test, it is about 25 times faster than my primes program in TSC Pascal. It is about 15 times faster than the Wirth Algorithm in TSC Pascal. I have written a Sieve program in BASIC, and it ran significantly faster than my other method. I just happened to settle on the divide test method for comparisons of compilers. I will have to write my algorithm in Assembler and see how fast it runs too. Meanwhile, I don't think anyone will improve on Brian's program for speed, unless maybe on a 68000 running at 8 or 10 Mhz.

NEW FROM LUCIDATA

Lucidata has a new product. It is a set of utilities that allow you to read directories and copy text files from "foreign" disks. It will work presently with Mini-FLEX, Smoke Signal Broadcasting DOS68, and Digital Research CP/M disks. Since SSB doesn't use TSC's method of space compression for a text file, there is even a utility that will convert a SSB file to standard FLEX format after it has been read from the SSB disk to a FLEX disk. I tried the Mini-FLEX utilities with instant success. I've been trying to get a disk from a friend who has CP/M to try, but haven't yet obtained it.

Along with the Directory and Copy utilities, (or should I say COPY and CATalog), there is a super utility called ANALYSIS. Analysis allows you to read a track, dump a sector, or do a statistical analysis of a track, that may be useful in determining why you can't read a particular foreign disk. All of the copy and catalog utilities are given in source code form. If you are able to do a track dump of some disk, and are smart enough or have enough time to dig, you may modify one of the copy utilities to work with another similar system. Consult Lucidata (or their ad in '68') for pricing details.

PROGRAMMING LANGUAGES

Since a few months ago when I wrote some critical things about FORTH documentation from the Forth Interest Group, I've been severely stomped on by a couple of FORTH fans. Partly as a result of that column, I now have both tFORTH and XFORTH. Both work quite well. They have nicely done screen editors. Neither happened to have an editor version for my old AOM-3, so I had to get in and modify the supplied ones. They both have FORTH source screens for their editors, and the chore wasn't terribly difficult, about an evening each. In an effort to give FORTH a better try, I have managed to get the program REVERSE (see 101 Games in BASIC, published by Creative Computing, Morristown, NJ) translated into both versions of FORTH. There were some rather subtle differences in the way STRINGS work in the two versions, and I had some digging to do to make REVERSE work properly in both, but it is done, and the listing is half as long as the Pascal version. I have an Assembler program with lots of math routines, that lists 23 pages or so, and I decided to try converting it to FORTH too. I have all the calculation parts converted, probably about 12 pages worth, and it only took 5 screens, (less than two pages) of FORTH to do it. Further, it only took an evening to get it written and working.

I'd like to launch into a discussion of programming languages here. The main reason that languages are so different is that their authors (be they individuals, committees, or interest groups) started the language development with certain goals in mind. Not all languages are written with the same goals. For example, BASIC was written to be a beginner's language. It is intended to be easy to learn. It is sort of a way to "get your feet wet" with programming without having to make so many conscious decisions over details. Some people have felt that too many decisions were left out of BASIC. The most notable one being the ability to format the output of a number. Most of the extended BASIC compilers have added more or less standard output formatting features such as PRINT USING, etc.

BASIC's best feature, that of being easy to learn, does not mean that it is not a powerful language. I've found that I can do anything that I can do in other languages in BASIC too. The original BASIC was implemented as an interpreter as opposed to a compiler. It had, as do all interpreter BASIC versions, simple edit functions, so that a program could be edited and run interactively. If you have never used a compiler, you probably don't appreciate this interactive method of debugging a program. When I do what I would call "exploratory programming", the first steps toward working out an algorithm to solve a particular problem, I most often choose BASIC to work with. After I have something running, and find that I have an understanding of my problem, I switch to a compiled language to gain the speed that comes with a compiler over an interpreter.

Pascal was designed with quite another goal. Wirth's primary goal certainly was to design a language that would be excellent for teaching programming. Wirth is one of the foremost advocates of structured programming, so of course he would design the language to permit or even force the programmer to use structured programming techniques. The result is that a Pascal program listing is excellent documentation of the program. The structure of a program in Pascal is more formal than one in BASIC. It forces the programmer to think a bit longer about the variables he is going to use, and what they represent. A few of the extended BASIC's make a distinction between integer and floating point (Real) variables. Pascal makes a definite distinction between these types and has many other variable types.

As a result of the design of Pascal, a program written by a reasonably proficient programmer who has "caught the spirit" of Pascal is very easy for another programmer to read, understand, and change. In other words, the maintainability of the program is greatly enhanced by the structured approach.

My personal observation is that the amount of listing (number of lines of code) required to do a program in Pascal, is about 1/7 of that required to do the same program in Assembler. The amount of time required to debug the program is probably in about the same ratio.

Pascal may be implemented as an interpreter, but I know of no such implementations for the 68xx. It is more generally implemented as something between an interpreter and a compiler. The source is translated to a high level instruction code sequence known as Pseudo code or P-code. The P-code is designed to run a "hypothetical" computer that has certain features. The P-code is then run by means of a simple interpreter that makes the actual processor look like the hypothetical machine. The original idea was to make P-code standard so that compiled Pascal programs could be run on various computers, the only differences being in the P-code interpreter for that machine.

Because of speed limitations, some versions of Pascal have been written to be "native code" compliers. That is, they directly generate object code for the particular processor for which they were designed. These usually execute code 3 to 10 times faster than the P-code versions, though they generally produce code less efficiently, ie. the number of bytes of output per page of listing may be greater with the native code versions.

FORTH was not designed to be easy to learn, nor was it primarily designed to be a structured language (though it does force structured programming since it has no GOTO statement, and many of the structured programming constructs have been added to it. I'm convinced that the primary goal of FORTH is to do a maximum amount of work with a minimum amount of source code. I never cease to be amazed that I can write a memory dump program in two lines. I did a Sine, Cosine, Arctangent (to 3 decimal places) program in three screens (one page) of source code. FORTH takes a lot of getting used to and a great deal of effort and memorization to gain reasonable proficiency in it. Once mastered, however, it will let you do a great deal in a short time. It is almost as interactive as BASIC, the editing and running of programs being possible without exiting FORTH. It comes complete with its own operating system and editor, which you can tailor for your needs.

FORTH is frustrating to learn because what some of the words do seems arbitrary and inconsistent with what other similar ones do. It requires a lot of memorization or a good familiarity with a glossary so you can refresh your memory quickly. Most of debugging of a FORTH program is in finding out that words don't quite do what you thought they did. With proficiency, however, comes the ability to do some complex things very fast.

Fortunately, we don't all have to like the same things. The multiplicity of programming languages just means that each of us can find a suitable one for our needs. Your choice will depend on what you want to do with your computer as well as your personality and method of working. It is very fortunate for us as 68xx users that we have quite a few choices. Soon we will be seeing another language called "C". Some of us will like it and some won't. It will be another choice.

ITS EASY AS PIE

I have really enjoyed the recent commercials for office computers in which the operator types in and corrects the phrase "It's easy as PIE" You've all probably read the review in '68' by Randy Lewis of PIE, the text editor from Programma International, written by Tom Crosley. Tom presented me with a copy of his latest version optimized for the 6809 when I met him at the NCC show in Chicago. I was impressed with the early version, but this one runs twice as fast when doing a string search or a "relocation" of the edit window. I am using it now to write this text. Tom has a few more features in mind to make PIE even more versatile. Watch for the announcement of the official 6809 version.

HOW TO SAVE THAT TEXT IN MEMORY

Have you ever spent an hour typing in a text and then found that a short power interruption or some other snag has bombed the FLEX disk drivers and you can't save the file? That just happened to me at this point in this text. I had a utility in FLEX2 to save a text file from memory, and last time I nearly lost a file due to a power failure, I was going to get that utility and convert it to 6809 FLEX9 form. At any rate, I wasn't about to give up and type my whole file all in again from scratch particularly since I had been generating this "off the top of my head" as I went along. I decided to take a couple of chances and just found that if you boot FLEX and hit reset when it asks for the date, it doesn't overwrite memory with a test pattern. You then go to warmstart $CD03 for FLEX9, and use the SAVETXT utility, a listing of which is here. Since I didn't have SAVETXT in usable form, I did the next best thing and used SAVE. I first used the monitor to find the limits of the text file I had in memory. My text, having used PIE started at $4800, and ran almost to $72FF. After using SAVE, it is necessary to edit the file and delete all the control characters inserted when saving a binary file. With PIE it is not too much of a job since all control characters in the file are indicated by ·. In the text, and just deleting the extraneous characters restores the file to its good state. However, a SAVETXT utility will be much better.

I've found my 6800 program, which was written by my friend Paul Patrick, and modified it for 6809 and FLEX9 use. As a matter of general interest, the 6800 version was $117 bytes long, and the converted program is $105 bytes. I'm sure a more efficient 6809 version could be written. This was a simple translation. The byte savings were in using Y as the pointer to memory, thus avoiding much loading and saving of X as is necessary in the 6800 version.

Remember, if you get stuck as I did, boot FLEX9. Don't answer the date prompt, but hit reset instead, then find the memory limits for the save, and jump to flex WARMS via ©P CD03 G. All that remains is to use SAVETXT just as you would use SAVE for a binary file. You will find that your editor's text buffer always starts at the same address, so you will soon know what the starting address is. Then, just look through memory until you find the last part of the text you are trying to recover from memory, and you are all set.

While I am at it, I will include a FLEX2 version of the utility here. All the discussion above will apply to FLEX2 and the 6800 as well. With a few equate changes, the 6800 version will also run in MiniFLEX.

ASSEMBLER PROBLEM

In the May issue I posed a problem regarding an assembler program. The listing appeared in the June issue. Several readers have sent me listings produced by their assemblers that have the error marked and labeled "UNRESOLVED IN PASS 1". It appears that I don't have the latest version of either assembler (6800 or 6809). The problem, if you hadn't figured it out, was one of "multiple forward references". ORG PART2 is a forward reference. The assembler doesn't find the label PART2 until the very end of the first pass. It can't therefore handle the forward branch in the instruction BRA LABEL8, and the FDB LABEL8. It would require three passes in order to resolve these forward references, (ie. two to resolve the symbol addresses and the usual "second pass" to generate the code). Apparently the fact that the assembler didn't detect such errors was fixed in a later version than mine. Thanks to all those who were interested enough to send me listings generated by their assemblers.

```
  3                         OPT    NOG,PAG
100 ILLEGAL OPTION
  5                       *
  6                       *
  7                       * THIS PROGRAM WILL ALLOW SAVING OF A TEXT FILE FROM THE CONTENTS OF MEMORY
  8                       * IT IS POSSIBLE TO SCAN MEMORY WITH ANY OF THE AVAILABLE DUMP
  9                       * UTILITIES TO FIND THE LIMITS OF THE TEXT TO BE SAVED
 10                       *
 11                       * SYNTAX: SAVETXT,FILENAME,STARTADDRESS,ENDADDRESS
 12                       *
 13                       * THE EXTENSION WILL DEFAULT TO .TXT AND THE DRIVE TO WORKING
 14                       *
 15                       * ORIGINAL FOR 6800
 16                       * BY PAUL PATRICK
 17                       * YPSILANTI MICHIGAN
 18                       *
 19                       * CONVERTED FOR 6809
 20                       * BY ROB ANDERSON
 21                       * ANN ARBOR MICHIGAN
 22                       *
 23              A640 FCB    EQU    $A640    SYSTEM FILE CONTROL BLOCK
 24                       *
```

```
                    *
              A003  WARMS   EQU    $AD03      WARMSTART
              AD15  GETCHR  EQU    $AD15      GET CHARACTER FROM TERMINAL
              AD1E  PSTRNG  EQU    $AD1E      PRINT STRING ROUTINE
              AD2D  GETFIL  EQU    $AD2D      GET FILE NAME FROM COMMAND LINE
              AD33  SETEXT  EQU    $AD33      SET DEFAULT EXTENSION
              AD3F  RPTERR  EQU    $AD3F      REPORT ERROR
              AD42  GETHEX  EQU    $AD42      GET HEX VALUE FROM COMMAND LINE
                    *
                    *
              B403  FMSCLS  EQU    $B403      ERROR EXIT, CLOSE ALL OPEN FILES
              B406  FMS     EQU    $B406      CALL TO FILE MANAGEMENT SYSTEM
                    *
                    *
A100                        ORG    $A100
                    *
A100 20    19       SAVE    BRA    SAVE2
A102 01             VN      FCB    1          UTILITY VERSION NUMBER
A103                BEGADR  RMB    2          BEGINNING ADDRESS FOR SAVE
A105                ENDADR  RMB    2          ENDING ADDRESS FOR SAVE
A107                CURADR  RMB    2          CURRENT ADDRESS USED TO TEST FOR VALID ADDRESSES
                    *
                    * BAD ADDRESS EXIT
                    *
A109 CE    A1CD     BADADR  LDX    #MSG1
A10C BD    AD1E             JSR    PSTRNG
A10F 7E    AD03             JMP    WARMS
                    *
                    * GET THE NEXT ADDRESS FROM THE COMMAND LINE BUFFER
                    *
A112 CE    A840     NXTADR  LDX    #FCB
A115 BD    AD42             JSR    GETHEX
A118 C5    FF               BITB   #$FF
A11A 39                     RTS
                    *
                    * MAIN PROGRAM STARTS HERE
                    *
A11B CE    A840     SAVE2   LDX    #FCB
A11E BD    AD2D             JSR    GETFIL     GET THE FILE NAME FOR SAVE
A121 24    07               BCC    SAVE3
A123 86    15               LDAA   #21        FOR ERROR MESSAGE
A125 A7    01               STAA   1,X
A127 7E    A193             JMP    ERROR
                    
A12A CE    A840     SAVE3   LDX    #FCB       POINT AT FILE CONTROL BLOCK
A12D 86    01               LDAA   #1
A12F BD    AD33             JSR    SETEXT     TO .TXT
A132 8D    DE               BSR    NXTADR     GET STARTING ADDRESS FROM COMMAND LINE
A134 23    D3               BLS    BADADR     IS IT VALID?
A136 FF    A103             STX    BEGADR     SAVE IT
A139 8D    D7               BSR    NXTADR     GET ENDING ADDRESS
A13B 23    CC               BLS    BADADR
A13D FF    A107             STX    CURADR     SAVE IT
A140 30    01               INX
A142 FF    A105             STX    ENDADR
A145 B6    A107             LDAA   CURADR
A148 F6    A108             LDAB   CURADR+1
A14B F0    A104             SUBB   BEGADR+1
A14E B2    A103             SBCA   BEGADR
A151 25    B6               BCS    BADADR     ENDING ADDRESS LESS THAN STARTING
                    
A153 CE    A840     OPEN    LDX    #FCB
A156 86    02               LDAA   #2
A158 A7    00               STAA   0,X
A15A BD    B406             JSR    FMS        OPEN FOR WRITE
A15D 26    30               BNE    FILERR     BRANCH IF ERROR
                    
A15F FE    A103             LDX    BEGADR
A162 A6    00       SAVE4   LDAA   0,X+       GET A CHARACTER
A164 30    01               INX
A166 84    7F               ANDA   #$7F       REMOVE PARITY BIT
A168 81    20               CMPA   #$20       CONTROL CHARACTER?
A16A 24    04               BCC    SAVE5      NO
A16C 81    0D               CMPA   #$0D       IS IT A CR?
A16E 26    0E               BNE    SAVE6
A170 FF    A107     SAVE5   STX    CURADR
A173 CE    A840             LDX    #FCB
A176 BD    B406             JSR    FMS        WRITE TO DISK FILE
A179 26    18               BNE    ERROR
A17B FE    A107             LDX    CURADR
A17E BC    A105     SAVE6   CPX    ENDADR     DONE?
A181 26    DF               BNE    SAVE4      IF NOT GET ANOTHER
                    
A183 CE    A840             LDX    #FCB
A186 86    04               LDAA   #4
A188 A7    00               STAA   0,X
A18A BD    B406             JSR    FMS
A18D 27    0C               BEQ    EXIT       NO ERRORS
A18F A6    01       FILERR  LDAA   1,X        IF ERROR DETECTED GET ERROR NUMBER
A191 81    03               CMPA   #3         IS IT 3?
A193 27    09               BEQ    ASKDEL     IF NO FILE ALREADY EXISTS, ASK IF DELETE OK
                    *
                    * ERROR EXIT
                    *
A195 BD    AD3F     ERROR   JSR    RPTERR     REPORT ERROR
A198 BD    B403             JSR    FMSCLS     CLOSE FILES
A19B 7E    AD03     EXIT    JMP    WARMS
                    *
                    * DELETE OLD FILE ?
                    *
A19E CE    A1E6     ASKDEL  LDX    #MSG2      OK TO DELETE ORIGINAL FILE?
A1A1 8D    1D               BSR    ASK        PRINT MESSAGE
A1A3 26    F6               BNE    EXIT       EXIT IF NOT OK

A1A5 CE    A209             LDX    #MSG3      THE "ARE YOU SURE" BIT
A1A8 8D    16               BSR    ASK
A1AA 26    EF               BNE    EXIT

A1AC CE    A840             LDX    #FCB       NOW DELETE IT
A1AF 86    0C               LDAA   #12
A1B1 A7    00               STAA   0,X
A1B3 BD    B406             JSR    FMS
A1B6 26    DD               BNE    ERROR
A1B8 A6    00 24            LDAA   36,X
A1BB A7    04               STAA   4,X
A1BD 7E    A153             JMP    OPEN       NOW OPEN NEW FILE

A1C0 BD    AD1E     ASK     JSR    PSTRNG     PRINT THE MESSAGE
A1C3 BD    AD15             JSR    GETCHR     GET RESPONSE
A1C6 84    5F               ANDA   #$5F       MAKE IT UPPER CASE
A1C8 81    59               CMPA   #'Y        IS IT Y?
A1CA 39                     RTS
                    *
                    * MESSAGE STRINGS
                    *
A1CB 49 4C 4C 45    MSG1    FCC    'ILLEGAL ADDRESS SPECIFIED '
A1CF 47 41 4C 20
A1D3 41 44 44 52
A1D7 45 53 53 20
A1DB 53 50 45 43
A1DF 49 46 49 45
A1E3 44 20
A1E5 04                     FCB    4
A1E6 4D 41 59 20    MSG2    FCC    'MAY THE EXISTING FILE BE DELETED? '
A1EA 54 48 45 20
A1EE 45 58 49 53
A1F2 54 49 4E 47
A1F6 20 46 49 4C
A1FA 45 20 42 45
A1FE 20 44 45 4C
A202 45 54 45 44
A206 3F 20
A208 04                     FCB    4
A209 41 52 45 20    MSG3    FCC    'ARE YOU SURE? '
A20D 59 4F 55 20
A211 53 55 52 45
A215 3F 20
A217 04                     FCB    4

                            END    SAVE

1 ERROR(S) DETECTED

SYMBOL TABLE:

ASK    A1C0  ASKDEL A19E  BADADR A109  BEGADR A103  CURADR A107
ENDADR A105  ERROR  A195  EXIT   A19B  FCB    A840  FILERR A18F
FMS    B406  FMSCLS B403  GETCHR AD15  GETFIL AD2D  GETHEX AD42
MSG1   A1CB  MSG2   A1E6  MSG3   A209  NXTADR A112  OPEN   A153
PSTRNG AD1E  RPTERR AD3F  SAVE   A100  SAVE2  A11B  SAVE3  A12A
SAVE4  A162  SAVE5  A170  SAVE6  A17E  SETEXT AD33  VN     A102
WARMS  AD03
```

REMARKS

Well, we are about over moving day now, actually moving two weeks or so.

Computer Publishing Incorporated (CPI), parent company of 68 Micro Journal, Data-Comp Division and S.E. Media Supply has grown at a steady rate, over the past three years. We started out in the offices with Hamilton Publishing Inc. and later moved our office staff to the Hamill Road address in Hixson, Tennessee, where we have operated from for the past 2 and a half years. But our 'wall expander' could budge no more, so we moved into our new building known as 'Computer Publishing Center'. Computer Publishing Center is now home for all the family operations of CPI. Everything that is but a portion of the 68 Micro Journal editorial offices.

My personal office is still located at the old Hamill Road address in Hixson, Tennessee. Just couldn't bear to leave the horses, dogs, cats and my favorite fishing hole on the creek. Only about a mile and a half from the new offices so things worked out ok. By the time this is out we should have our new telephone system completed and will be able to keep in touch should any call.

Please use our new address shown below in all future correspondence as the post office is already having some slight difficulty getting our mail forwarded in a timely manner.

Computer Publishing Center
5900 Cassandra Smith Road
Hixson, TN 37343
(615) 842-4600

Last month I published our annual survey, for the first time. And I want to say that the response has been far more than I ever anticipated. Some very interesting data and view-points have emerged from this response of many hundreds of 68 Micro Journal readers. What is even more interesting is that some are not even subscribers and DO NOT own 68XX systems. Their input was in most all cases (about 27) reasons why they had opted not to go the 68XX route. In practically every case it was due to some dissatisfied 68XX user 'bad mouthing' the 68XX systems, or so they report. Twenty seven is not a very large number but it should not have happened. That they would even take the time to respond (they have no subscription to extend) is surprising. It behooves all of us, manufacturers and end users alike, to have a better understanding of each others problems and gripes. As users we have a relatively large investment, we would like to have better and less expensive accessories and software for our systems. Also we would like more 'quality control', a lot more! This was one of the most, if not the most stressed remark in the entire survey. As retailers and manufacturers some of us need to 'get our act straight'. This includes our sister organizations, Data-Comp and S.E. Media Supply. There is some mighty potent competition knocking on the door and the 'old days' are about gone. There is no doubt that we (Standard S50 Bus users) have one of, if not the finest small computer (and some not so small) systems available today. But now is not the time for sitting and beaming, rather it is a time to look about and decide what we can do to make our lot better, and help assure our survival.

One other thing that catches my attention as I review the surveys as they come in is that a very high percentage are well satisfied with their systems. Not that they do not have complaints and gripes, but they know that the outsiders have had probably more problems than we have. All in all we have had the best of it, despite a few bad apples and a lot of growing pains Standard S50 Bus industry wise.

As soon as we can get the data all sorted out I will be reporting to you on some portions of this survey. So far, including data we had previously, we have over 2,000 survey inputs, that are fairly recent. From this amount of data some fairly accurate conclusions can be made.

Also I have been receiving a large amount of mail from those who either want to do reviews for the TRS-80 Color Computer (6809) or would like to be placed on a list of available hard/software programmers and designers. I will attempt to keep this list as current as possible. The response to both of these was so great that I will not be able to reply to each and everyone. But if anything comes up, that you might slot into, you will be hearing from someone. Meanwhile I want to thank all who responded, even tho I doubt that I can ever use all that volunteered for reviews.

DMW - - - -

COLOR USER NOTES

* * COLOR COMPUTER *Users Notes* * *

by Robert L. Nay
Rt 7 Box 290A, Gadsden, Al. 35903

INTRODUCTION:

Many of you have noticed the "Development" of a magazine, especially a specific coverage "rag" like '68' MICRO JOURNAL. It begins by filling a need - ie, in this case, coverage of the 68XX world. It starts with a group of people with a special interest and desire, and grows and develops with the people who are the prime contributers and supporters. '68' MICRO JOURNAL has done an excellent job of tying the 68XX users together, and the contributers and supporters are to be commended. A simple but comprehensive Buss System has evolved with a standardization and flexibility that is the envy of the competition. And it works! and Works! and WORKS! This has resulted in the extremely rapid development of powerful and flexible Operating Systems with a high degree of compatability and utilization of the most powerful 8-bit CPU chip available. To the newcomer to the 68XX scene, it may seem that the primary following of '68' MICRO is working on a Multi-K system with Disks stacked everywhere, at Multi-Meg speeds. Consequently, every once-in-a-while, a small QUESTION MARK comes floating up out of all the DOUBLE SIDE/TRACK/DENSITY, MULTIUSER, PIPELINE, DOS, DMA, etc., in the hope it can find a small crack to hang onto and pull itself up to a level that it can at least get a glimpse of something understandable and usable.

Then, finally, a crack appears. A POWERFUL marketing system throws a little tidbit to the hungry questioners; the RADIO SHACK COLOR COMPUTER. It often seems that many an engineering manhour went into making it as secret and non-standard as the mightyest brains could dream up; yet, it's got almost as much latent power per dollar invested as an Atomic Bomb. It's being bought by the thousands; as a toy for grandchildren; as a tool to try to teach logical thinking and processes to school children; as an interesting little computer to play with by the pros; and, MOST IMPORTANTLY, by the Multitude who want to learn what makes a computer tick and how to use one. I would venture to guess that the great majority of this last group of purchasers are young, venturesome, questing, determined, and, normally, BROKE. The COLOR COMPUTER is a pathway into the "Land Of The Computers", and the price of admission isn't bad. The COLOR COMPUTER purchasers have rapidly gone through the SHACK's "meager" information, broken the Cartridges' secret "theft of the computer", found it to be extremely easy to DOUBLE the maximum memory Tandy had provided (at ANY cost), and is making inroads into breaking the "CLASSIFIED-HIGHEST POSSIBLE TOP SECRET" BASIC ROM code.

GENERAL:

This all leads up to the "COLOR COMPUTER Users Notes". Every issue of '68' MICRO JOURNAL has at least one, and usually several, cries for information on a less sophisticated system. I AM NOT IN ANY WAY insinuating that '68' MICRO JOURNAL back off of the level of the information it is presenting. It is a fantastic publication. Personally, I've found it takes me longer to read an issue of the '68' MICRO JOURNAL than any of the much larger publications; this little gem is CRAMMED with information. I'm suggesting, especially to you "pros", that we include 'us' "not-so-hep, struggling to get there too" folks in this publication also. The present "battleground" seems to be in the areas of Sorting and Programming Methods; how about some discussions on File Handling Techniques, Look-up Tables, Linking methods, etc., etc. Remember, a lot of the new '68' MICRO JOURNAL readers havn't "been there" yet, so how about passing on what may seem to be a simple or basic bit of information; there will be many that will learn from it. Send it to me, to Don, to the Bit Bucket, but SEND IT!

We'll be looking at and discussing ANYTHING that pertains to the COLOR COMPUTER in this column. The machine was designed to be an inexpensive system with a good TV graphics capability, and that it IS. Its' strong points are the price (since it hooks directly to a TV, a Monitor does not have to be purchased); an outstanding version of BASIC that was fine tuned for TV graphic display and audio output (it "Benchchecks" right up with the 4MHz '80' systems on an interpretive operating system even though the COLOR COMPUTER clock runs at less than 0.9MHz - re Aug 81 "Interface Age" p88); and it uses the 6809E chip. The electronics consist of 4 different 40 pin LSI's, the Power Supply, and a few odd chips. Weak areas are primarily the results of holding the price down and making the system so specialized. The keyboard is a plastic "calculator type" switching system which is prone to result in sticky key buttons (read on! I'll give you a FIX for that shortly), but does have good "feel" once you get used to it and the actual switches should be trouble-free and are easy to clean should the need arise. The Keyboard Output gives you very little in the way of non-alphanumeric codes for controlling a Printer and the RS-232 "SERIAL I/O" pin connections are a typical Radio Shack fouled-up mess (also some solutions to follow). The BASIC being in ROM is "safe" in that programming errors won't wipe it out, but they tie up a lot of real estate, restricting you to a maximum of 48K useable memory until we get it out on Disk or Cassette (I've already run out of my 32K a couple of times). In general, it's a good system with fantastic potential, and we do have some excellent software and hardware becoming available for it (also MORE info shortly). Finally, the physical design and construction of the electronics sure are'nt up to very high standards. I have already repaired five bad solder joints in my set, so if you are'nt "hep" on electronic repairs, don't void your 90 day warranty. It seems that about 70% of the COLOR COMPUTERS are going to need some work; stay close to your Salesman because my experience with two different Radio Shack Computer SERVICE CENTERS has been BAD; your Salesman can help get a problem solved, where I've found the Service Center personnel to have a "I could care less" attitude. Conversely, I've found the MOTOROLA people to be EXTREMELY HELPFUL and interested in any problem you may have with a specific chip.

COLOR COMPUTER!

First, let's look at a few things that will greatly improve your chances of having a trouble-free COLOR COMPUTER. The biggest problem that normally shows up is heat. The Power Supply generates quite a bit of heat, and the 6883 SAM also run hot. On my unit, the Cassette operation became unreliable after a couple hours computer time. The 6821 PIA's then became intermittant, causing both "Load" and "Save" problems. The solution is two-fold: first, make sure air can flow freely through the chassis and second, read and accomplish the procedures outlined by Bob Margeson in the May 81 issue of '68' MICRO JOURNAL beginning on page 30. In addition to ventilating the Power Transformer mounting area and painting the RF Shield cover black, I also drilled a BUNCH more holes in the shield and installed an IC heat sink on the 6883. I have not had a problem since I accomplished those changes. Next item: I have heard of some problems with the 32K "piggy-back" mod (it has been written up several times as Bob did, and normally it works OK). If the 4116 memory chips are good, etc., then the problem is probably "ringing" on the chip select pins. This can be a real puzzle, and normally shows up with the faster 4116's. What is causing the problem is the exceptional speed of the 6883 SAM chip! It is not a MOS device. The solution is to replace the plain wire lead going from the 4116 pin 4's (chip select) with a 33 ohm resistor! This will provide enough damping to eliminate the problem. The Printed Circuit Land on the PC Board has enough inductance to prevent the problem on the first 16K chips, the resistor takes care of the second set. Next, the "sticky Keys". This drove me up a tree for a while! I tried several things which either didn't work or created a real mess. Finally, the light dawned - POWDERED GRAPHITE. Dust around the keys - pour it on good - and run your hand up and down the Keyboard, working it between them (like you've seen "kids" run their hand up a piano keyboard. After it's worked in good, and the edges of the key buttons look like they have been rubbed with a pencil, take a relatively soft brush and sweep the excess off. I havn't had a problem since I did mine, and I sure have used it hard and heavy since. Finally, be extremely careful when plugging Cartridges in and out. In fact, DON'T do it with power on the COMPUter. That's the SAFE way. You can blow the 6809E CPU and/or the 6883 SAM chips if your luck is bad, so why risk it. I know, you see kids yanking them out and stuffing them in in the store, and things work fine. If you look close at the Board Edge in the Radio Shack Cartridges, you will notice that one PC Land does not come all the way out to the edge. That is the +5 Volt land, and it insures that all other connections are made before Power is applied to the Cartridge if the Computer is turned on (acceptable for TANDY). BUT, why take the chance? Also, most of the other Cartridges available for the COLOR COMPUTER do NOT have that land shortened! If you get used to inserting and removing the RS Cartridges with power on, you may forget when you use a different unit. As Ron Anderson so aptly put it in his Aug column, the probability of your wiping out a chip is so near a sure thing that there is little use in trying to calculate it. TURN THE MACHINE OFF for inserting or removing Cartridges, and you won't have a problem.

REVIEWS!

DATASOFT, INC.
16606 Schoenborn Street, Sepulveda, Ca. 91343

S.E.C.S. (Screen Edit Control System) Cassette Tape; $29.95

REQUIREMENTS: 4K to use the EDITOR! 16K for the Character Generator and Hi-Resolution Graphics. Extended Basic NOT required.

FEATURES: 4K system - the EDITOR portion of the Program is the only part of the Program that is useable on a 4K COLOR COMPUTER. The EDITOR provides the capability of Editing Basic Statements thru the insertion or deletion of characters without having to re-type the whole Statement. The Program is loaded by entering CLOADM"SECS" and then EXEC <ENTER>, and displays a backward slash with a black flashing cursor. You then operate as though the program was not loaded in the computer except for the Editing capability (ie., all normal commands and functions are entered and used just as if S.E.C.S. was not loaded in the Computer). This portion of the program works good and no problems were noted.

16K system - The extra memory allows the use of the Hi-Res portions of this Program (the HI-Res portions allocate and use either 3K or 6K video screens the same as Extended Basic). This Program is loaded with CLOADM "CG-SECS" and then EXEC <ENTER>. This loads the Editor and the Hi-Res capabilities (and also DISABLES EXTENDED BASIC if it is installed). The Hi-Res Graphics provides various screen Color, Dot, and Line functions equivalent to Ext. Basic's PMODE 1 (SECS's CLS SET=3) and PMODE 2 (SECS's CLS SET=6). One interesting feature of SECS is that while in the CLS H mode, you do not have the Keyboard display on the scr n, but you DO have keyboard control (ie, CLS H,3 provides a red screen, then if you enter SET (15,10,1), a yellow dot appears at location 5,10. In addition, since you could not see an error message - remember, no keyboard display!, you're working blind - an audio warning is provided to indicate an error). You may want a note pad handy when working this mode.

The Character Generator is a BASIC Program loaded with CLOAD "PCG-EDIT" and then RUN. This brings up a "menu" consisting of 10 single-key commands yielding tape controls, screen, color, and resolution control, and the "E" for end of program. These commands are functional AFTER the Character Generator Display is up. <ENTER> brings it up from the menu. This was one place we ran into a problem! ENTER was hit while the Char. Gen. Display was being produced - it wiped out the whole program. We had to shut the Computer down to clear memory and reload the program! We were unable to get back from RESET or to reload and reEXECute until a complete Power-On RESET was accomplished. (We also did it two more times with the same results to make sure it wasn't a fluke - be careful which keys you hit when in the Char. Gen. mode!) This mode presents 64 characters and allows you to change them to develop your own characters, and store them on tape for use later.

DOCUMENTATION: The instructions with this program leave a lot to be found out the hard way -- it took us over a half hour to get the Program up and running. We read thru the instructions and started at the beginning by loading the 4K editor to check it out with the CLOADM "SECS" and EXEC routine. It looked OK, so on to the Hi-Res Graphics: so we thought. Again, the "can't get there from here" problem we mentioned with the char. gen. If you have loaded and EXECuted "SECS", there is no way to get BASIC's EXEC Pointer back, we had to shut down and come back from a Power-On start to be able to get CLOADM"CG-SECS" to EXEC. (We also verified this a couple times, and with both copies of the program on the tape: once the EXEC Pointer is used, even the tape programs do not reset it.) This would normally not be a problem because you will normally only use the Programs that applies to your system - my point is that proper documentation would have prevented the problem. Also, if you had WANTED the 16K version of the program to start with (CG-SECS), you would still have run into this problem because the instructions do not specifically identify a loading procedure for each one, nor are they very specific about which does what (we assumed the EDITOR must do something besides insert and delete chars., which is the only thing the instructions discusses, and since there was no mention of getting back and forth between BASIC and the EDITOR, AND since we were already familiar with the EXEC problem, we started trying different things and found out that you have normal BASIC operation and functions while in the EDITOR mode). Since this Program is obviously intended for the new Computer users with a basic system, the Documentation should be very complete, and provide a Guide to help new operators get it "up and running" with NO problems. (On the same subject, while the EXEC Pointer problem will not really be a Problem with this program, it is a weak point which should not be there. The Char. Gen. wipe-out problem IS a problem, and hopefully, steps will be taken to eliminate it.)

SUMMARY: This can be a good program for those systems without EXTENDED BASIC by providing a simple but needed EDITOR and an introduction to High Resolution Graphics if the documentation is aimed at that user and if a few minor "bugs" will be cured. S.E.C.S. does perform the functions you see advertised for it and could be a good program for the COLOR COMPUTER user.

DATASOFT, INC.
16606 Schoenborn Street, Sepulveda, Ca. 91343

BIGMON (Mach. Lang. Monitor, Debugger, and Mini-assembler)
Cassette Tape: $29.95

REQUIREMENTS: 16K Memory; does NOT require or use EXTENDED BASIC.

FEATURES: "BIGMON" is a powerful and versatile Machine Language Monitor, Debugger, and Mini-assembler, which gives you access to the machine language capabilities of your TRS80 COLOR COMPUTER (TRSCOC)." This quote is the first statement in the Instruction Manual, and precisely summarizes the Program. I have found it to be excellent and extremely useful, and it provides features I have not found in other programs of this type for the Color Comp.

The BIGMON Commands and their function are as follows (Note: parameters enclosed in these brackets <> are optional in the Command Line.)!

MODE <H> ---> "MODE" is the default command and requires all Hexidecimal Entries to be preceded by the dollar sign ($)(0FF, $A1C1). "MODE H" causes BIGMON to expect ALL numeric entries to be Hex.
PRT/NOPRT ---> "PRT" links the Printer to the Screen Display (ie., anything seen on the screen is printed)! NOPRT turns it off.
DUMP/DUMPB <start address>,<end address> ---> These Commands dump the current address in the left column, followed by 8 Hex bytes (ALL numeric outputs of BIGMON are Hexidecimal)! then, right below these bytes, the corresponding ASCII code if below $80, or a period if DUMP or a Graphic Block if DUMPB if over $80. It then proceeds with the next 8 bytes, etc.
LIST <start address>,<end address> ---> This Command produces a 25 byte row preceded by the address. The output is ASCII/Gr. Block.
DIS <start address>,<end address>---> This is the DISassemble Command. It is basically a single line disassembler (no labels, symbol tables, X-reference tables, etc.) with the output in the Address, Opcode, Operand, and Mnemonic field format, followed by the actual address referenced by the Opcode Offset for that programs' present position. Relative addressing would be shown as!
3000 A6 BC80 LDA 3010,PC to indicate relative to the PC.
FIND start address,end address,data ---> This lets you find almost any single or combination of values, including Mnemonic codes and displays the address or addresses at which it was found.
ASM start address ---> This is the Mini-assembler Command. It provides the capability of entering numeric or character values directly into memory, and operates as a single-line assembler when entering Mnemonics.
MOVE start-address,end-address,target-address ---> This provides the standard "move a block of memory from here to there" Command.
STEP <start address> ---> This command is the Master Tracer routine. It displays the current register contents and then the next line in Disassembled format. Pressing the Spacebar or any key then lists the registers from that statement and presents the next one. This continues until you either exit the mode with <ENTER> or get a "ROM! GO?" message, where a "Y" will proceed into the ROM and probably dump you back into BASIC, or an <ENTER> or "N" exits the mode.
BREAK addr1,addr2,addr3,...addr9 ---> This allows the insertion of up to 9 break-points in RAM when running a program. These cause an SWI to be inserted, and when encountered, the registers are displayed and the code which the breakpoint replaced is reinserted in the program. There are provisions for killing all brk-pts, any one, or displaying the current ones.
SET <reg-val> ---> "SET <ENTER>" displays the current registers: "SET CC=$80" would load the Cond. Code Register with Hex $80. All registers except the "S" can be assigned values.
GO <address> ---> This transfers program control to the address specified to "RUN" a Machine Language program.
SPEED <value> ---> This sets the video scrolling rate: value is 0-255.
EXIT ---> Returns you to BASIC.
WRITE "filename",start address,end address, <entry point>---> This produces a standard Mach. Lang. tape which can be read with either CLOADM or back into BIGMON.
READ ---> This Command reads a Mach. Lang. tape into BIGMON.
PLOAD ---> This function allows BIGMON to read a data file entered from the Serial Port at 600 Baud. The Data File format is specified in the Instructions.

GENERAL COMMENTS: BIGMON is a Relocatable machine language program which normally occupies memory locations $0FF2-$2762. It is an easy-to-use, forgiving program, quickly putting the user at ease with it. The DUMP, LIST, and DIS commands allow the analysis of small to large programs, but the system is more suited to shorter programs. The DISassembler can not interpret ASCII characters in code, but the DUMP or LIST commands point these areas of a program out, and the "junk" output from it in these areas can be ignored. Since it is basically a single line disassembler, it is not easily confused, and you will seldom need to restart it at the end of a String to get it "back in sync". The lack of labels, symbol tables, cross references, etc., is not a hinderance with small programs (or sections of large ones), and the "uncluttered" output is easy to follow. The output of the DISassembler appears

to be standard Motorola syntax, but I have not tried to run it on one of the full Assembler Systems yet. The SIGMON Assembler is as easy to use as the rest of the program, and follows the standard Motorola syntax except the "Auto Decrement" Mnemonics, where the minus signs must follow the register when using SIGMON, instead of preceding them. The SIGMON Monitor, Disassembler, and Assembler are very convenient to use for studying and inserting small changes to operational programs - you can easily change branch addresses, for example, to allow inserting a different capability into a program. For example, the following entries change the STEP Printer output to a single line listing of the registers if you have an 80 col. Printer, but do not affect the video output (it also extends the programs memory use to $2812):

```
Assembler Input:              DIS output after transfering the program
                                 to $4FF2 to check Relocatability:

 >>ASM $2386                  >>DIS $6386
 2386- BSR $27F8              6386   17 043F     LBSR 67F8
 2389-    (<ENTER> to exit. $2389 left unchanged)

 >>ASM $27F8                  >>DIS $67F8 $6812
 27F8- TST $271F,PC           67F8   6D 8DFF23   TST  671F,PCR
 27FC- BEQ $255A              67FC 1027 FD5A     LBEQ 655A
 2800- PSHS A                 6800   34 02       PSHS A
 2802- LDA $20                6802   B6 20       LDA $20
 2804- BSR $2510              6804   17 FD09     LBSR 6510
 2807- CLR $271F,PC           6807   6F 8DFF14   CLR  671F,PCR
 280B- BSR $255A              680B   17 FD4C     LBSR 655A
 280E- BSR $21E5              680E   17 F9D4     LBSR 61E5
 2811- PULS A,PC              6811   35 82       PULS PC,A
 2813-    (again, <ENTER> to exit the mode)
```

DOCUMENTATION: The Documentation that comes with SIGMON is excellent. Provided are two booklets: an Instruction Manual and a "highlight commented" Source Code booklet. The major portions of the program consist of the Command Parser, Dis-assembler, Step Processor, Single Line Assembler, standard Monitor Command section, and the I/O package section. The Instruction Manual lets you know right off the bat just what you have, a discussion of the TRSBASIC tape buffer area, how to load the tape, and the programs use in conjunction with BASIC and the USR statement. There is very little confusion about what you have or how to use it, and NONE about how to get "up and running". I would suggest a note on a recommended Book for use with the Assembler (ie, what is the "standard Motorola syntax", for those just beginning to get into Machine Language programming - and this program is one of the best I have seen for starting out), but in general, the Documentation is outstanding.

SUMMARY: This is an outstanding offering for use on the COLOR COMPUTER. The price is very reasonable, and both beginners and pros alike will find it to be a valuable addition to their software library. As previously stated, it is easy to use for those just beginning to delve into Machine Language Programming, and is really nice for those "small changes" to programs, or for whipping out a simple program without having to figure branches and offsets manually. OUTSTANDING PROGRAM!!

QUICK LOOKS:

This section of the "COLOR COMPUTER Users Notes" will be devoted to presenting an initial look at new products that have come in for review. We will then provide more complete coverage of many of the products in a later "Users Notes" column (normally the next issue). It is felt that this format will help both the prospective purchaser and the manufacturer by providing an objective view of the product in a timely fashion, and still provide us with the time to use it enough to be able to present a good review as soon as possible. Many new products are becoming available for this system, and our primary concern is to get the information out to you quickly. Drop us a note and let us know your opinion on this procedure, and we will do our best to accomodate you.

The MICRO WORKS
P.O. Box 1110 Del Mar, Ca. 92014

CBUG MONITOR (available either on TAPE or in a ROM)

CBUG is an approximately 2K monitor which is entirely relocatable. Instructions are provided for installing the ROM version in a Tandy Diagnostics Pak (and I will show how to make it switch selectable to allow use of either the Diagnostics or CBUG next month). CBUG provides Register display, Memory exam/change, Insert, Transfer blocks of mem, JSR, Change reg., Save to Cassette, Set baud rate, Load hex to mem, Upload and Download, setting break points, hex to decimal & vice versa, a couple of terminal modes, and an interesting "Move display page" functions. All this is normally accomplished with single-key commands. The Instructions provide a commented Source Listing and some good info on Hi-Res Graphics on the COLOR COMPUTER. It is an excellent program - I have it on ROM in the Diagnostics Pak and just leave it plugged in almost all the time; it's a handy item to have "on board".

80C DISASSEMBLER (on TAPE)

The 80C DISASSEMBLER is a full-function disassembler which allows specifying different area types at the discovered locations and provides 6 different output formats. It is a 2-pass disassembler which identifies labels and provides full symbol and cross reference tables. The output can be directed to either the screen of to a Printer. One of the output options provides a standard Source Code format, which can be edited as required and run on a standard Assembler. It was designed primarily to disassemble the BASIC ROM's in the COLOR COMPUTER, and the Instructions give a Memory Map of Computer and some interesting Addresses in the BASIC ROM. A note on interfacing a printer to the COLOR COMPUTER is also included. Finally, a fully commented Source listing is provided. As to be expected from The MICRO WORKS, this is another excellent piece of software.

SDS 80C (Software Development System)

The SDS 80C is a Cartridge which plugs in the Cartridge slot on the COLOR COMPUTER. It contains three separate programs: an Editor, an Assembler, and a Monitor. (The Monitor is a special version of the CBUG mentioned previously, called ABUG.) The Editor comes up first, and is used for entering source code and editing code entered from the keyboard or mass storage. Typing the at symbol (@) gets from the Edit mode to the Assemble mode; when called, several options can be choosen from developing symbol tables to generate code to memory, tape, and/or printer. The SDS 80C supports all standard instructions, address modes, and mnemonics, and in addition, it features support of local labels, conditional assembly, 6800 instructions for cross-assembly, and control of the output listing. Pseudo Op codes supported include the conditional assembly codes of IFxx, ELSE, EIF (End IF); the standards like RMB, END, EQU, FCB, FCC, FDB, NAM, ORG, and RMB; the SETDP to inform the assem. that DP has been set; OPT, PAGE, and TTL for compatability with other Assemblers; and NLST/LIST for listing control. SPC leaves a blank line to provide program readability and to delimit Local Variables. You are automatically transfered to the ABUG Monitor after an Assembly run. This monitor provides single-key commands including the normal Go, Memory examine/change, Register list/change, Transfer blocks of memory, Jump to subroutine, and Save/Load cassette. It also supports a command to Evaluate expressions (? NERF -- prints the value of NERF; ? $12*+$3CA+$FF) -- a Hex calculator, etc.), and a command to Unstack, or remove the symbol table to free memory space. The $ symbol returns you to the Editor from the Monitor, and the = gets you from the Assembler back to the Editor. The Instruction Manual provided does not provide the commented Source Listing you are used to seeing from The MICRO WORKS, but this is by far the best Manual they have produced in the COLOR COMPUTER software line. Besides the discussions of the three programs' use, there is a summary of the 6809 Assembly Language and Appendices on Memory Full Conditions, ROM Entry Points, Timing Loops, Interfacing a Printer, Use with the Disassembler, and ASCII and Screen Codes. The 6809 Assembly Language section also discusses Position Independent Code (PIC) and 6800 Cross-assembly and it's potential problems.

INTERFACING the COLOR COMPUTER with a PRINTER:

The SERIAL I/O connector on the back of the COLOR COMPUTER is the only link with a Printer that Radio Shack has provided so far. Their Literature has provided more confusion than good information; it looks like Microsoft (which wrote the BASIC and Control System) and Tandy were on different wave lengths as far as the Serial Output port is concerned.

The Serial Data out of this port is formated as 1 start bit (always low), 7 data bits, and 2 stop bits (always high) with no parity. This works all right if the only thing you want out of this port is ASCII characters, but it imposes some restrictions if you want to use some of the newer printers with the COLOR COMPUTER, as the Graphics Blocks and some of the Control Codes need the 8th bit. Tandy has finally realized this, and now provides a free (yep, FREE) Cassette TaPe routine which loads in high RAM (to them; it doesn't read the amount of memory and adjust it's location, and it is not relocatable, so it will have to be adjusted to get it out of the way on the 32K and over systems - we'll look at this next month) called PTFX. It is Catalog Number 700-2013, and one side (PTFX4K) loads into a 4K machine, and the other side of the tape (PTFX16) loads into the 16K machines. This provides the 8 bit output for Graphics Blocks, etc. By the way, the APPLE II only puts out 7 bits also, and it has some of the Control Codes trapped so that a few of the Printer software Controls are real hard to use. Tandy's normal attitude of "we're the greatest, let the world conform to US" got bent a little bit when they began selling the Line Printer VII, which needs the 8th bit, just like Epsons MX series, so they provided us with it (I would guess this also means that the rest of the world can now produce Printers using 8 bit inputs).

OK, we have the data going out to the Printer: it leaves the Computer Serial I/O port on pin 4 of the 4-pin DIN connector in the Computer. This is labeled "TD", or Transmit Data, in the TRS-80 COLOR COMPUTER OPERATION MANUAL supplied with the Computer, and is correctly labeled. This output will go to the "RD", or Receive Data, pin on Printer connector, which will be pin 3 of the standard RS-232C 25 pin connector found on almost any Printer with a Serial Input. Pin 3 on the Computer is labeled GROUND, which is what it really IS. (Wow, two for two right, so far.) This will go to the Printers' GROUND (sometimes called CHASIS or SIGNAL GROUND, also - in most cases they are the same thing); this will be pin 1 on the standard 25 pin connector. So far, we have info going from the computer to the printer, and the grounds tied together (so that +5 Volts at the computer will be +5 Volts at the printer too); now the fun starts. The Computer must be able to tell when the Printer is "Busy", and doesn't have time to "Receive Data" right now; this is accomplished by hooking the "busy" line (also called "busy out" or "status out" in some units) from the Printer to the "Status In" or "Carrier Detect" line on the Computer. But, IT WILL NOT WORK on the COLOR COMPUTER. The "CD" line, pin 1 on the COL. COMP., is not monitored by the BASIC Operating Systems' printer Character Output routine; pin 2, labeled "RD" (Receive Data) is the input that is monitored to check for "Printer Busy". This means that the "busy" signal out of the Printer (pin 20 on a standard 25 pin RS-232 connector) must be hooked to pin 2 of the COLOR COMPUTERS' Serial I/O connector. Also, pin 2 on the Computer must be high to allow it to send data to the printer, or "enable the output". Most Printers have several switches which allow the selection of various options, and the choice of "busy" high or low to enable the Computers output will be one of them. While I think of it, another term used with printers for "busy" is "Printer Buffer Full" or "Printer Buffer NOT Full". As you can see, this can also get confusing! what the Computer must see is a HIGH signal on pin 2 before it will send data to the Printer - that's about as "unconfused" as I can think of to put it! So, what we end up with, if all this discussion hasn't clouded things even more, is:

```
COLOR COMPUTER              PRINTER
   pin 1 ----- no connection
   pin 2 ----------------- pin 20 = BUSY   (standard RS-232C conn)
   pin 3 ----------------- pin 7  = GROUND           "
   pin 4 <---------------- pin 3  = REC DATA         "
```

Now that we are able to communicate with a printer, what is the COLOR COMPUTER capable of saying?? Well, in "speaka-da-English", it does OK! but in "speaka-da-PRINTER", it don't do so good. It was designed to do all kinds of fancy things, in COLOR even, on a TV Screen; that it does GREAT. But it lacks a few non-English, non-TV Screen keys on the keyboard to allow talking fluent PRINTER. Far and away the greatest shortcoming is the lack of an "escape" key which generates a Hex Code "1B" when pressed. The second major shortcoming is the lack of a "Control" key. Working around the Control key won't be too bad, as it's major area of useage is in Software situations, and the software can be written to define an available key to handle this function; but the Escape key is another problem. The majority of a versatile printer's commands are preceded by the Escape key; since it has no ASCII alphanumeric character, it is invisible for printer OUTPUT, and therefore is used to alert the printer to the fact that the character immediately following it is not to be printed, but is to be used as a command telling it to change line spacing, character type, etc. With the MX-80, almost half of the commands use the Escape key, and 36 of the 52 commands used in the new GRAFTRAX 80 Bit-Plot Graphics Printer option require it. Driving a printer from BASIC is no problem as far as the Escape Code is concerned; it is CHR$(27). The CHR$(xx) expression will output ANY Code with this Computer; the pro-

blem with using BASIC for printing this column, for instance, is that you sure would get tired of typing PRINTe-2,"#x something sa" for EACH INDIVIDUAL LINE of print you see written here. This problem can also be overcome with properly written software; you have no idea how much I'm looking foreward to receiving Nelson Software Systems' SUPER "COLOR" WRITER wordprocessor for this machine (a full report on it will be in this column next month, too). The <CLEAR> key puts out $0C, which is the normal Printer Control for Form-Feed; I have modified a few of my programs to change a $0C to $1B and use the <CLEAR> key for Escape. The Epson MX-80 has a Form-Feed button handy, so I just "do without" using it in the text - it's not optimum, but it does allow much greater control of the Printer within the text. The COLOR COMPUTER does not output a Line-Feed with the Carrige-Return. This means that the LF must either be generated thru software, or with switch selections in the Printer. Personally, I feel it should be switch selected, and software written with that in mind; otherwise, we will have to change switch selections each time we run a different program, which is not easy on some printers. The MX-80 has several options available in this area, and the new GRAFTRAX 80 option provides a "Home Printer Head" command which simplifies underlining (which doesn't work on mine - it may be inop with the Serial Board).

This whole discussion has assumed the use of a printer with a Serial Data Input. I see The MICRO WORKS is advertising an adapter which plugs into the SERIAL I/O port on the COLOR COMPUTER, and gives a Radio Shack compatabile edge connector parallel output so you can use a Radio Shack standard cable to plug into the Parallel Data port on a printer; I haven't seen it yet, but with their name on it, I sure wouldn't hesitate to purchase one. There will probably be others out soon; these will at least eliminate the Col. Comp. RD/CD confusion.

Finally, some notes on baud rates. The COLOR COMPUTER default baud rate is 600; that is, anytime it goes through the RESET cycle, it sets the Printer baud rate at 600. This is controlled by the value in memory locations $95 and $96 (149 and 150). The baud rate can be set to other values as follows:

```
 110 baud = $01F3     POKE 149,1:POKE 150,202
 300 baud = $0084     POKE 149,0:POKE 150,188
 600 baud = $0057     POKE 149,0:POKE 150,87
1200 baud = $002B     POKE 149,0:POKE 150,43
2400 baud = $0012     POKE 149,0:POKE 150,18
```

Since the MX-80 does not quite run up to 600 baud, I normally don't worry about setting it any different - with the 2K Buffer Serial Input Board, the computer will be back up before the printer is through printing. The R.S. Quick Printer II that I was running some will not quite take 600 baud; I had to POKE 150,93 to slow the computer output slightly to keep the printer from missing a character now and then.

I hope this hasn't been too long-winded and helps some of you get your printers on line and operating like they should. If any of you have solved problems with interfacing specific printers, drop me a line, or better yet, a "bit bucket" letter, and clue us in.

SIGN-OFF:

Next month, we'll be looking at The MICRO WORKS excellent products for the COLOR COMPUTER, SUPER "COLOR" WRITER from Nelson Software Systems, our first look at some of the DISK Systems becoming available, and a whatever else I feel may help you get better use of the COLOR COMPUTER. Once more, drop us a line and let us know what you like and dislike about the column; we'll stumble along blindly until we start getting some feedback from you.

Link Loader /09 Part 2

(The entry point of WRBNRC is after 4 bytes of link area) The load map published will probably have a different value for this entry point than the one on the distribution disk. Also, you will have to remove the CTR 0 definition in the MODULE macro.

Once you assemble each hand-linked module, use the FLEX GET routine to load them into memory. WARNING! You may need to use some value for the link record identifiers other than $FFF0-$FFF3, since GET will wipe out your DAT if you are using SWTPC equipment!

The major reason I am publishing this effort is my firm belief that the 6809 is one of the best micros around. It does suffer from a lack of available software, however, and anything which will allow the needed software to be more easily written will foster greater acceptance of the chip.

Therefore, I am giving RLOAD away, and I plan to do the same thing with other utility software I am currently working on. Anyone who wishes to do so may copy and distribute (with enhancements, I hope!) RLOAD without any royalties. Of course, I would like to be given credit for the original, but I'm not going to invest any effort in trying to enforce that.

For added convenience, I will provide machine-readable source and binary, including this article (formatted for TSC's PR processor), on a 5" single-density FLEX diskette for $15.00. Additional copies of the floppy in the same order are $4.00 each. (Limit 10, please) And hardcopy of the entire RLOAD program is $5.00. Of course, if this copy of '68' is your own, you won't need the printed listings. Please do NOT send diskettes. This price includes the cost of the floppy, postage and packaging, and a little profit. At least, I hope not to LOSE any money, should more than four or five of you actually send for it.

If anyone out there is interested in starting a software exchange library or user's group similar to the excellent CP/M effort, let me know.

Since I am not (yet) really in the software business, updates to RLOAD may be a problem. For instance, I plan to add the SORT routine before I get any orders, but other features may come afterwards, and I don't want to have to charge a lot of money to update somebody's copy of RLOAD just because he bought it too soon, and I don't want to delay sending out the program because I'm in the process of adding another feature. The solution, I think, is to publish any new features in this magazine, and supply source listings of any new feature with self-addressed, stamped envelope, at 10 cents per page. Again, if you subscribe to '68', that should be enough. If you don't, you ought to. Since the subroutines tend to be short and modular, the effort in typing in one or two of them should not be too burdensome. After all, this is what a linking loader is all about!

I have been told that I am not charging enough. That may be true, and I may be headed for some hassle in that regard. However, I will guarantee the price quoted here for a least one month after the cover date of the issue in which this appears. After that, if it is necessary, I may raise the price. I hope not to.

Current plans also include adding 8" disks to my system, so I may be able to furnish this program on 8" disks in a couple of months.

Address inquiries/orders to WORD's WORTH, PO Box 28954, Dallas, Texas 75228. Please include your actual home or business address, not a PO box, so that I can use UPS for out-of-state orders. As if you didn't already know, FLEX is a trademark of Technical Systems Consultants.

```
ABSPRO   6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS, PLACED IN PUBLIC DOMAIN, 1981.

0000                    MODULE 'ABSPRO  - RLOAD VERS 2.0 '
                        ********************************
                        * PROCESS ABS RECORD.  SIMILAR TO ENT RECORD, EXCEPT NOT
                        * NECESSARY TO RELOCATE.
                        * INPUTS - RY POINTS TO THE BYTECOUNT OF A BINARY RECORD
                        *          IN A BUFFER (NOT IN THE FCB BUFFER)
                        * OUTPUTS- RY=TRASH, RX PRESERVED
                        *
0000                            ENT   ABSPRO
0000                            EXT   ENTER     MAKE TABLE ENTRY
0002                            EXT   SEARCH    SEARCH TABLE FOR ENTRY
0004                            EXT   SYMMEND   ADDRESS OF WORD CONTAINING
                        *                       CURRENT EOT
0006                            EXT   SYMTAB    TABLE ADDRESS
0008                            EXT   ZCOPY     SPECIAL COPY ROUTINE
                        *
000A                            EXT   MEMEND    END OF MEMORY (FLEX)
000C                            EXT   PCRLF     (FLEX)
000E                            EXT   OUTHEX    (FLEX)
0010                            EXT   PSTRNG    (FLEX)
                        *
                  0006  ADDFLD  EQU   6         ADDRESS FIELD OF ENTRY IN TABLE
                        *
                  0012  ABSPRO  EQU   *
0012 36   10                    PSHU  X
                        * SKIP THE BYTE COUNT (WE DON'T NEED IT)
0014 31   21                    LEAY  1,Y
```

```
0016 30   8D 0076          LEAX   TMPLT,PCR
001A C6   06                LDB    #6          NUMBER OF BYTES TO COPY (MAX)
001C AD   9C E9             JSR    [ZCOPY,PCR]
                  * GET LINK RECORD ADDRESS FIELD (RY LEFT POINTING THERE,
                  * RX POINTS TO ADDRESS FIELD OF TEMPLATE)
001F EC   A4                LDD    ,Y
0021 ED   84                STD    ,X
                  * SEARCH TABLE FOR ENTRY
0023 AE   8C E0             LDX    SYMTAB,PCR
0026 31   8D 0066           LEAY   TMPLT,PCR
002A EC   9C D7             LDD    [SYMMEND,PCR]
002D AD   9C D2             JSR    [SEARCH,PCR]
0030 81   85                CMPA   #YES
0032 27   1B                BEQ    CHKIT
                  * ENTRY IS NOT IN TABLE. SO ENTER IT.
0034 C6   08                LDB    #8          LENGTH OF ENTRY
0036 36   04                PSHU   B
0038 31   8D 0054           LEAY   TMPLT,PCR
003C AE   9C CB             LDX    [MEMEND,PCR]
003F 36   30                PSHU   Y,X
0041 10AE 8C BF             LDY    SYMMEND,PCR
0045 AE   8C BE             LDX    SYMTAB,PCR
0048 36   30                PSHU   Y,X
004A AD   9C B3             JSR    [ENTER,PCR]
004D 20   0C                BRA    EXIT

ABSPRO                                  6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

                  *
                  * ENTRY EXISTS. CHECK TO MAKE SURE THAT IT IS AN EXT
                  * ENTRY, AND NOT A DUPLICATE DEFINITION
                  *
                  004F CHKIT  EQU    *
004F EC   06                LDD    ADDFLD,X
0051 1083 FFFF              CMPD   #UNDEF
0055 26   27                BNE    ERROR
                  * UPDATE THE ADDRESS FIELD ONLY
0057 EC   26                LDD    ADDFLD,Y
0059 ED   86                STD    ADDFLD,X
                  *
                  0058 EXIT   EQU    *
0058 AD   9C AE             JSR    [PCRLF,PCR]
005C 30   8D 002E           LEAX   TMPLT,PCR
0060 30   06                LEAX   ADDFLD,X  SPACE OVER TO ADDRESS FIELD
0062 AD   9C A7             JSR    [OUTHEX,PCR]
0065 30   01                LEAX   1,X
0067 AD   9C A2             JSR    [OUTHEX,PCR]
006A 30   8D 0020           LEAX   TMPLT,PCR
006E 86   04                LDA    #EOS
0070 A7   86                STA    ADDFLD,X
0072 30   8D 0016           LEAX   LEADR,PCR
0076 AD   9C 95             JSR    [PSTRNG,PCR]
                  007B ERRXIT EQU    *
0078 37   10                PULU   X
007D 39                     RTS
                  *
                  007E ERROR  EQU    *
                  * NULL OUT ADDRESS WORD, SO THAT THE ENTRY TEMPLATE
                  * CAN BE USED AS PART OF THE ERROR MESSAGE.
007E CC   0000              LDD    #0
0081 30   8D 000B           LEAX   TMPLT,PCR
0085 ED   06                STD    ADDFLD,X
0087 AD   9C 86             JSR    [PSTRNG,PCR]
008A 86   02                LDA    #ERR
008C 20   ED                BRA    ERRXIT
                  *
008E 20 20        LEADR FCC    '  '
0090              TMPLT RMB    8          EIGHT-WORD TABLE ENTRY TEMPLATE
0098 20 44 55 50  ERRMSG FCC   ' DUPLICATE ENTRY POINT DEFINITION',EOS
009C 4C 49 43 41
00A0 54 45 20 45
00A4 4E 54 52 59
00A8 20 50 4F 49
00AC 4E 54 20 44
00B0 45 46 49 4E
00B4 49 54 49 4F
00B8 4E 04
                  *
00BA                        ENDMOD
                            END

ABSPRO                                  6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS, PLACED IN PUBLIC DOMAIN, 1981.

0 ERROR(S) DETECTED
```

```
ABSPRO                                  6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

SYMBOL TABLE:

ABSORG FFF3   ABSPRO 0012   ADDFLD 0006   CHKIT  004F   COMMA  002C
CR     000D   CTRØ   0012   END    000A   ENTER  0000   ENTORG FFF2
EOF    0008   EOS    0004   EQ     0085   ERR    0082   ERRMSG 0098
ERROR  007E   ERRXIT 007B   EXIT   0058   EXTORG FFF1   FOUND  0083
GT     0086   LEADR  008E   LF     000A   LT     0087   MEMEND 000A
MODORG FFFØ   NO     0084   OK     0081   OUTHEX 000E   PCRLF  000C
PSTRNG 0010   RSTX   0002   RTRX   0016   SEARCH 0002   SPACE  0020
SYMMEN 0004   SYMTAB 0006   TMPLT  0090   UNDEF  FFFF   YES    0085
ZCOPY  0008

ENTER                                   6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

 0000                       MODULE 'ENTER    - RLOAD VERS 2.0 '
                  ********************************************
                  * MAKE ENTRY IN TABLE.
                  * INPUTS ON STACK IN ORDER:
                  *      U+0 TABLE ADDRESS
                  *      U+2 ADDRESS OF TABLE END POINTER
                  *      U+4 MAXIMUM TABLE ADDRESS
                  *      U+6 ADDRESS OF ENTRY TO BE MADE
                  *      U+8 LENGTH OF ENTRY
                  * THE PRELIMINARY VERSION OF ENTER DOES NOT USE ALL OF
                  * THIS INFORMATION, BUT SUBSEQUENT VERSIONS MIGHT.
                  * OUTPUTS - U STACK CLEANED UP.
                  *
0000                        ENT    ENTER
0000                        EXT    FLEX
0002                        EXT    FMSCLS
0004                        EXT    PSTRNG
                  *
                  * POINTERS INTO U STACK (PARAMETERS)
                  *
                  0000 TABLE  EQU    0
                  0002 TEMP   EQU    2
                  0004 TMAX   EQU    4
                  0006 NTRY   EQU    6
                  0008 SLEN   EQU    8
                  *
                  0006 ENTER  EQU    *
0006 AE   D8 02             LDX    [TEND,U]
0009 34   10                PSHS   X          IU IN USE)
000B E6   48                LDB    SLEN,U
000D 3A                     ABX               NEW END-OF-TABLE ADDRESS
                  * CHECK TO SEE THAT THERE IS ROOM TO MAKE ENTRY
000E AC   44                CMPX   TMAX,U
0010 2C   14                BGE    PANIC
0012 AF   D8 02             STX    [TEND,U]  UPDATE END-OF-TABLE
0015 35   10                PULS   X
                  *
0017 10AE 46                LDY    NTRY,U    (RB STILL HAS LENGTH)
                  * COPY THE ENTRY INTO THE TABLE
                  001A COPY   EQU    *
001A A6   A0                LDA    ,Y+
001C A7   80                STA    ,X+
001E 5A                     DECB
001F 26   F9                BNE    COPY
0021 86   81                LDA    #OK
0023 33   49                LEAU   9,U       CLEAN HOUSE
0025 39                     RTS
                  *
                  0026 PANIC  EQU    *
0026 30   8D 0009           LEAX   PNCMSG,PCR
002A AD   9C D7             JSR    [PSTRNG,PCR]
002D AD   9C D2             JSR    [FMSCLS,PCR]

ENTER                                   6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

0030 6E   9C CD                JMP    [FLEX,PCR]
0033 53 59 4D 42  PNCMSG FCC    'SYMBOL OVERFLOW ABORT',$07,EOS
0037 4F 4C 20 4F
003B 56 45 52 46
003F 4C 4F 57 20
0043 41 42 4F 52
0047 54 07 04
004A                        ENDMOD
                            END

0 ERROR(S) DETECTED
```

```
ENTER                                   6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

SYMBOL TABLE:

ABSORG FFF3   COMMA  002C   COPY   001A   CR     000D   CTRØ   0006
END    004A   ENTER  0006   ENTORG FFF2   EOF    0008   EOS    0004
EQ     0085   ERR    0082   EXTORG FFF1   FLEX   0000   FMSCLS 0002
FOUND  0083   GT     0086   LF     000A   LT     0087   MODORG FFF0
NO     0084   NTRY   0006   OK     0081   PANIC  0026   PNCMSG 0033
PSTRNG 0004   RSTX   0002   RTRX   0016   SLEN   0008   SPACE  0020
TABLE  0000   TEND   0002   TMAX   0004   UNDEF  FFFF   YES    0085

ENTPRO                                  6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

 0000                       MODULE 'ENTPRO   - RLOAD VERS 2.0 '
                  ********************************************
                  * PROCESS ENT RECORD.
                  * INPUTS - RY POINTS TO THE BYTE COUNT OF A BINARY
                  *              LOGICAL RECORD
                  *          RX HAS BASE ADDRESS OF MODULE
                  *          A BUFFER (NOT IN THE FCB BUFFER)
                  * OUTPUTS- RY=TRASH, RX PRESERVED
                  *
0000                        ENT    ENTPRO
0000                        EXT    ENTER     MAKE TABLE ENTRY
0002                        EXT    SEARCH    SEARCH TABLE FOR ENTRY
0004                        EXT    SYMMEND   ADDRESS OF WORD CONTAINING EOT
0006                        EXT    SYMTAB    TABLE ADDRESS
0008                        EXT    ZCOPY     SPECIAL COPY ROUTINE
                  *
000A                        EXT    MEMEND
000C                        EXT    PCRLF
000E                        EXT    OUTHEX
0010                        EXT    PSTRNG
                  *
                  0006 ADDFLD EQU    6         ADDRESS FIELD OF ENTRY IN TABLE
                  *
                  0012 ENTPRO EQU    *
0012 AF   8D 0081           STX    MBASE,PCR
                  * SKIP THE BYTE COUNT (WE DON'T NEED IT)
0016 31   21                LEAY   1,Y
0018 30   8D 007F           LEAX   TMPLT,PCR
001C C6   06                LDB    #6         NUMBER OF BYTES TO COPY (MAX)
001E AD   9C E7             JSR    [ZCOPY,PCR]
                  * GET LINK RECORD ADDRESS FIELD (RY LEFT POINTING THERE,
                  * RX POINTS TO ADDRESS FIELD OF TEMPLATE)
0021 EC   AA                LDD    ,Y
0023 E3   8D 0070           ADDD   MBASE,PCR RELOCATE
0027 ED   84                STD    ,X
                  * SEARCH TABLE FOR ENTRY
0029 AE   8C DA             LDX    SYMTAB,PCR
002C 31   8D 006B           LEAY   TMPLT,PCR
0030 EC   9C D1             LDD    [SYMMEND,PCR]
0033 AD   9C CC             JSR    [SEARCH,PCR]
0036 81   85                CMPA   #YES
0038 27   1B                BEQ    CHKIT
                  * ENTRY IS NOT IN TABLE. SO ENTER IT.
003A C6   08                LDB    #8         LENGTH OF ENTRY
003C 36   04                PSHU   B
003E 31   8D 0059           LEAY   TMPLT,PCR
0042 AE   9C C5             LDX    [MEMEND,PCR]
0045 36   30                PSHU   Y,X
0047 10AE 8C B9             LDY    SYMMEND,PCR
004B AE   8C B8             LDX    SYMTAB,PCR
004E 36   30                PSHU   Y,X
0050 AD   9C AD             JSR    [ENTER,PCR]

ENTPRO                                  6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

0053 20   0C                BRA    EXIT
                  *
                  * ENTRY EXISTS, CHECK TO MAKE SURE THAT IT IS AN EXT
                  * ENTRY, AND NOT A DUPLICATE DEFINITION
                  *
                  0055 CHKIT  EQU    *
0055 EC   06                LDD    ADDFLD,X
0057 1083 FFFF              CMPD   #UNDEF
005B 26   29                BNE    ERROR
                  * UPDATE THE ADDRESS FIELD ONLY
005D EC   26                LDD    ADDFLD,Y
005F ED   86                STD    ADDFLD,X
```

```
                        *
0061                    EXIT    EQU     *
0061 AD  9C A8                  JSR     [PCRLF,PCR]
0064 30  8D 0033                LEAX    TMPLT,PCR
0068 30  06                     LEAX    ADDFLD,X  SPACE OVER TO ADDRESS FIELD
006A AD  9C A1                  JSR     [OUTHEX,PCR]
006D 30  01                     LEAX    1,X
006F AD  9C 9C                  JSR     [OUTHEX,PCR]
0072 30  8D 0025                LEAX    TMPLT,PCR
0076 86  04                     LDA     #EOS
0078 A7  06                     STA     ADDFLD,X
007A 30  8D 001B                LEAX    LEADR,PCR
007E AD  9C 8F                  JSR     [PSTRNG,PCR]
0081                    ERRXIT  EQU     *
                        * RESTORE RX
0081 AE  8D 0012                LDX     MBASE,PCR
0085 39                         RTS
                        *
0086                    ERROR   EQU     *
                        * NULL OUT ADDRESS WORD, SO THAT THE ENTRY TEMPLATE
                        * CAN BE USED AS PART OF THE ERROR MESSAGE.
0086 CC  0000                   LDD     #0
0089 30  8D 000E                LEAX    TMPLT,PCR
008D ED  06                     STD     ADDFLD,X
008F AD  9D FF7D                JSR     [PSTRNG,PCR]
0093 86  82                     LDA     #ERR
0095 20  EA                     BRA     ERRXIT
0097                    MBASE   RMB     2
0099 20 20              LEADR   FCC     '  '
009B                    TMPLT   RMB     8       EIGHT-WORD TABLE ENTRY TEMPLATE
00A3 20 44 55 50        ERRMSG  FCC     ' DUPLICATE ENTRY POINT DEFINITION',EOS
00A7 4C 49 43 41
00AB 54 45 20 45
00AF 4E 54 52 59
00B3 20 50 4F 49
00B7 4E 54 20 44
00BB 45 46 49 4E
00BF 49 54 49 4F
00C3 4E 04
                        *
00C5                            ENDMOD
```

ENTPRO 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

```
                                END
```

0 ERROR(S) DETECTED

ENTPRO 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

SYMBOL TABLE:

```
ABSORG FFF3   ADDFLD 0006   CIOXIT 00C5   COMMA  002C   CR     000D
CTR0   0012   END    00C5   ENTER  0000   ENTORG FFF2   ENTPRO 0012
EOF    0008   EOS    0004   EQ     0085   ERR    0082   ERRMSG 00A3
ERROR  0086   ERRXIT 0081   EXIT   0061   EXTORG FFF1   FOUND  0083
GT     0086   LEADR  0099   LF     000A   LT     0087   MBASE  0097
MEMEND 000A   MODORG FFF0   NO     0084   OK     0081   OUTHEX 00BE
PCRLF  00BC   PSTRNG 0010   RSTX   0002   RTRX   0016   SEARCH 0002
SPACE  0020   SYMMEN 0004   SYMTAB 0006   TMPLT  009B   UNDEF  FFFF
YES    0085   ZCOPY  0008
```

EXTPRO 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

```
0000                            MODULE 'EXTPRO    - RLOAD VERS 2.0 '
                        ********************************************
                        * PROCESS EXT RECORD.
                        * INPUTS - RY POINTS TO THE BYTE COUNT OF A
                        *           LOGICAL BINARY RECORD.
                        * OUTPUTS- RY=TRASH. RX PRESERVED
                        *
0000                            EXT     EXTPRO
0000                            EXT     ENTER     MAKE TABLE ENTRY
0002                            EXT     SEARCH    SEARCH TABLE FOR ENTRY
0004                            EXT     SYMMEND   ADDRESS OF WORD CONTAINING EOT
0006                            EXT     SYMTAB    TABLE ADDRESS
0008                            EXT     ZCOPY     SPECIAL COPY ROUTINE
                        *
000A                            EXT     MEMEND
                        *
000C                    EXTPRO  EQU     *
000C 36  10                     PSHU    X
                        * SKIP THE BYTE COUNT (WE DON'T NEED IT)
000E 31  21                     LEAY    1,Y
0010 30  8D 0037                LEAX    TMPLT,PCR
0014 C6  06                     LDB     #6        NUMBER OF BYTES TO COPY (MAX)
0016 AD  9C EF                  JSR     [ZCOPY,PCR]
                        * MARK AS NOT YET DEFINED, IN THE TEMPLATE.
                        * RX POINTS TO ADDRESS FIELD OF TEMPLATE)
0019 CC  FFFF                   LDD     #UNDEF
001C ED  84                     STD     ,X
                        * SEARCH TABLE FOR ENTRY
001E AE  8C E5                  LDX     SYMTAB,PCR
0021 31  8D 0026                LEAY    TMPLT,PCR
0025 EC  9C DC                  LDD     [SYMMEND,PCR]
0028 AD  9C D7                  JSR     [SEARCH,PCR]
002B 81  85                     CMPA    #YES
002D 27  19                     BEQ     EXIT      ALREADY IN THERE
                        * ENTRY IS NOT IN TABLE, SO ENTER IT.
002F C6  08                     LDB     #8
0031 36  04                     PSHU    B
0033 31  8D 0014                LEAY    TMPLT,PCR
0037 AE  9C D0                  LDX     [MEMEND,PCR]
003A 36  30                     PSHU    Y,X
003C 10AE 8C C4                 LDY     SYMMEND,PCR
0040 AE  8C C3                  LDX     SYMTAB,PCR
0043 36  30                     PSHU    Y,X
0045 AD  9C B8                  JSR     [ENTER,PCR]
0048                    EXIT    EQU     *
0048 37  10                     PULU    X
004A 39                         RTS
                        *
004B                    TMPLT   RMB     8         EIGHT-WORD TABLE ENTRY TEMPLATE
0053                            ENDMOD
                                END
```

EXTPRO 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

0 ERROR(S) DETECTED

EXTPRO 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

SYMBOL TABLE:

```
ABSORG FFF3   COMMA  002C   CR     000D   CTR0   000C   END    0053
ENTER  0000   ENTORG FFF2   EOF    0008   EOS    0004   EQ     0085
ERR    0082   EXIT   0048   EXTORG FFF1   EXTPRO 000C   FOUND  0083
GT     0086   LF     000A   LT     0087   MEMEND 000A   MODORG FFF0
NO     0084   OK     0081   RSTX   0002   RTRX   0016   SEARCH 0002
SPACE  0020   SYMMEN 0004   SYMTAB 0006   TMPLT  0048   UNDEF  FFFF
YES    0085   ZCOPY  0008
```

EXT2 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

```
0000                            MODULE 'EXT2      - RLOAD VERS 2.0 '
                        ********************************************
                        * PROCESS EXT RECORD.
                        * INPUTS - RY POINTS TO THE BYTE COUNT OF A
                        *           LOGICAL BINARY RECORD.
                        * OUTPUTS- RA,B,Y=TRASH, RX PRESERVED
                        *
0000                            ENT     EXT2
0000                            EXT     RDBNRC    READ BINARY RECORD
0002                            EXT     SEARCH    SEARCH TABLE FOR ENTRY
0004                            EXT     SYMMEND   ADDRESS OF WORD CONTAINING EOT
0006                            EXT     SYMTAB    TABLE ADDRESS
0008                            EXT     ZCOPY     SPECIAL COPY ROUTINE
                        *
                        ADDFLD  EQU     6
                        DATA    EQU     4
                        *
000A                    EXT2    EQU     *
000A 36  30                     PSHU    X,Y
                        * SKIP THE BYTE COUNT (WE DON'T NEED IT)
000C 31  21                     LEAY    1,Y
000E 30  8D 002B                LEAX    TMPLT,PCR
0012 C6  06                     LDB     #6        NUMBER OF BYTES TO COPY (MAX)
0014 AD  9C F1                  JSR     [ZCOPY,PCR]
                        * SEARCH TABLE FOR ENTRY
0017 AE  8C CC                  LDX     SYMTAB,PCR
001A 31  8D 001F                LEAY    TMPLT,PCR
001E EC  9C C3                  LDD     [SYMMEND,PCR]
0021 AD  9C CE                  JSR     [SEARCH,PCR]
0024 AF  8D 001D                STX     ENTADD,PCR
                        * READ THE NEXT RECORD INTO THE ORIGINAL BUFFER,
                        * AND STUFF THE ENTRY POINT ADDRESS INTO IT.
0028 10AE 42                    LDY     2,U
002B 31  3D                     LEAY    -3,Y      BACK TO START OF RECORD
002D AE  C4                     LDX     ,U
002F AD  9C C6                  JSR     [RDBNRC,PCR]
0032 AE  8D 000F                LDX     ENTADD,PCR
0036 EC  06                     LDD     ADDFLD,X
0038 ED  24                     STD     DATA,Y
003A                    EXIT    EQU     *
003A 37  30                     PULU    X,Y
003C 39                         RTS
                        *
003D                    TMPLT   RMB     8         EIGHT-WORD TABLE ENTRY TEMPLATE
0045                    ENTADD  RMB     2         PLACE TO SAVE TABLE POINTER
0047                            ENDMOD
                                END
```

0 ERROR(S) DETECTED

EXT2 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

SYMBOL TABLE:

```
ABSORG FFF3   ADDFLD 0006   COMMA  002C   CR     000D   CTR0   000A
DATA   0004   END    0047   ENTADD 0045   ENTORG FFF2   EOF    0008
EOS    0004   EQ     0085   ERR    0082   EXIT   003A   EXT2   000A
EXTORG FFF1   FOUND  0083   GT     0086   LF     000A   LT     0087
MODORG FFF0   NO     0084   OK     0081   RDBNRC 0000   RSTX   0002
RTRX   0016   SEARCH 0002   SPACE  0020   SYMMEN 0004   SYMTAB 0006
TMPLT  003D   UNDEF  FFFF   YES    0085   ZCOPY  0008
```

GETNAM 6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

```
0000                            MODULE 'GETNAM    - RLOAD VERS 2.8 '
                        ********************************************
                        * GET A FILE NAME FROM THE LINK FILE.
                        * INPUT RX=LINK FILE FCB
                        * OUTPUT RX=BINARY FILE FCB (OPEN)
                        *
0000                            ENT     GETNAM
                        *
0000                            EXT     FMS
0002                            EXT     PSTRNG
0004                            EXT     RPTERR
0006                            EXT     SETEXT
0008                            EXT     RDFCB
                        *
000A                    GETNAM  EQU     *
000A 10AE 8C FA                 LDY     RDFCB,PCR
000E 86  00                     LDA     #0
0010 C6  40                     LDB     #$40      WIPE OUT FIRST 64 BYTES OF FCB
0012                    WIPE    EQU     *
0012 A7  A0                     STA     ,Y+
0014 5A                         DECB
0015 26  FB                     BNE     WIPE
0017 10AE 8C ED                 LDY     RDFCB,PCR
001B 31  24                     LEAY    FNAME,Y   POINT TO NAME FIELD
                        * GET NEXT NAME FROM LINK FILE. FIRST, SKIP OVER LEADING
                        * BLANKS, COMMAS, & CARRIAGE RETURNS
001D                    GET1    EQU     *
001D AD  9C E0                  JSR     [FMS,PCR]
0020 26  30                     BNE     CAN'T
0022 81  0D                     CMPA    #CR
0024 27  F7                     BEQ     GET1
0026 81  20                     CMPA    #SPACE
0028 27  F3                     BEQ     GET1
002A 81  2C                     CMPA    #COMMA
002C 27  EF                     BEQ     GET1
002E                    GET2    EQU     *
                        * COPY UP TO THE NEXT SPACE, CR, COMMA
002E 81  0D                     CMPA    #CR
0030 27  11                     BEQ     GETXIT
0032 81  20                     CMPA    #SPACE
0034 27  0D                     BEQ     GETXIT
0036 81  2C                     CMPA    #COMMA
0038 27  09                     BEQ     GETXIT
003A A7  A8                     STA     ,Y+
```

```
003C AD  9C C1          JSR   [FMS.PCR]
003F 26  1E             BNE   CANT
0041 20  EB             BRA   GET2
         0043   GETXIT   EQU   *
0043 AE  8C C2          LDX   RDFCB.PCR
0046 4F                 CLRA
0047 AD  9C BC          JSR   [SETEXT.PCR] BINARY FILE
004A 86  01             LDA   #OPEN
GETNAM                                  6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

004C A7  84             STA   FUNCTN,X
004E 86  01             LDA   #1
0050 A7  03             STA   DRIVE,X
0052 AD  9C A8          JSR   [FMS.PCR]
0055 26  09             BNE   CANT
0057 86  FF             LDA   #$NREAD
0059 A7  88 3B          STA   COMPRFL,X
005C 86  81             LDA   #OK
         005E   EXIT    EQU   *
005E 39                 RTS
                *
         005F   CANT    EQU   *
005F A6  01             LDA   ERRSTAT,X
0061 81  08             CMPA  #EOF
0063 27  F9             BEQ   EXIT
0065 36  10             PSHU  X
0067 30  8D 000C        LEAX  MNAME,PCR
006B AD  9C 94          JSR   [PSTRNG,PCR]
006E 37  10             PULU  X
0070 AD  9C 91          JSR   [RPTERR,PCR]
0073 86  82             LDA   #ERR
0075 20  E7             BRA   EXIT
                *
0077 47 45 54 4E MNAME  FCC   'GETNAM WAS UNABLE '
007B 41 4D 20 57
007F 41 53 20 55
0083 4E 41 42 4C
0087 45 20
0089 54 4F 20 4F        FCC   'TO OPEN BINARY FILE'.EOS
008D 50 45 4E 20
0091 42 49 4E 41
0095 52 59 20 46
0099 49 4C 45 04
009D                    ENDMOD
                        END
0 ERROR(S) DETECTED

GETNAM                                  6-13-81 TSC ASSEMBLER
AUTHOR: HL HARKNESS. PLACED IN PUBLIC DOMAIN, 1981.

SYMBOL TABLE:

ABSORG FFF3   BNREAD 00FF   CANT   005F   COMMA  002C   COMPRF 003B
CR     000D   CTRØ   000A   DRIVE  0003   END    0090   ENTORG FFF2
EOF    0008   EOFFLA 0008   EOS    0004   EQ     0085   ERR    0082
ERRSTA 0001   EXIT   005E   EXTORG FFF1   FCLOSE 0004   FMS    0000
FNAME  0004   FOUND  0083   FUNCTN 0000   GET1   001D   GET2   002E
GETNAM 000A   GETXIT 0043   GT     0086   LF     000A   L1     0087
MNAME  0077   MODORG FFF0   NO     0004   OK     0081   POSITN 0015
PSTRNG 0002   PURGE  000C   RDFCB  0008   RENAME 0080   REWIND 0005
ROPEN  0001   RPTERR 0004   RSTX   0002   RTRX   0016   SETEXT 0006
SPACE  0020   UNDEF  FFFF   UPDATE 0003   WIPE   0012   WOPEN  0002
YES    0085
```

To be continued...

WAVE MATE 2000

Despite a host of new 6809 computers being introduced for the past few years, a new version using an old favorite the MC6800, has started to take hold. Introduced by WAVE MATE, an old established microcomputer manufacturer, the Series 2000 proves that old is not the same as obsolete. The 2000 is a solid 2 mhz, dual density, dual disk 5" single cabinet microcomputer system. Available also with 5 and 8 inch external disk systems and a winchester for the heavy user. Which indicates that the 6800 is still 'one fine CPU'.

The specifications are quite impressive and our unit has performed flawlessly for over six months. They are as follows:
Temperature range 50-90 degrees fahrenheit (10-35 celsius) with a maximum relative humidity rating of 80% (non-condensing). The 2000 is 13" high, 17" wide, 20" deep and weighs in at 44 pounds. The finish is grey and off white. CPU 68800, 2mhz clock, programmable interrupt and on board real time clock. Internal memory 64K of RAM with hidden refresh and 1K Boot ROM and diagnostics. Disk storage is now external with either 40 or 80 track double sided drives. 40 track disk subsystem is 184,320 bytes per disk capacity. 80 track capacity is 368,640 bytes per disk. With the 80 track system the total 'on line' capacity is 1,474,560 bytes. Access time is 12 ms track to track, 270 ms average random access. Two drives standard, however a maximum of four 5" drives may be used.

Video display 12 inches diagonal, P4 phosphor. Format is 24 line by 80 characters with a 25th line programmable. A full 95 character displayable ASCII set, plus 33 graphic symbols. Display mode either normal or reverse. Character type is Upper Case 5X7 dot matrix, Lower Case 5X9 dot matrix with true descenders. Graphics 8X10 dot matrix. Cursor shape block or underline, blinking. Cursor controls, up, down, left, right and home. Cursor addressing either relative or absolute.

The keyboard is a standard commercial typewriter keyboard. Alphanumeric 60 keys, special functions 8 (user programmable) and 12 normal function keys. Numeric pad is 12 key numeric, cursor control, editing and user programmable function. Some very nice 'Special Features' are system reset key, ESC sequences, control key, keyboard lock/unlock from host processor and break key.

I/O 2 serial RS232C ports, software selectable rates 110,300,1200,2400, 4800 and 9600 baud. Expansion ports available, three slots. Winchester disk optional, 11 megabytes. For those needing additional I/O there is available a wire wrapping prototype board, with connectors, retail is $35.00.

The cabinet is of structural foam (Zenith) with removeable top. The three circuit boards are, 1) CPU, memory, disk controller and I/O. 2) Video logic board (Zenith). 3) Video display board (Zenith).

Power requirements, 100/220 VAC, 50/60 hz, 90 watts.

SOFTWARE

The 2000 has four (4) operating systems. FLEX©, Software Dynamics SOOS© and the Wave Mate real time disk operating system, MTS-6800© Multi-Tasking OS. TFORTH has been accomplished for this system by Dr. Ray Talbot. Also a complete package of UCSD PASCAL.

On initial power the system accomplishes a memory test and then the disk is automatically booted. Also during power on the video board and other internal systems are tested. If a defect is detected the system displays a message that helps locate the defective part. This can save a lot of grief later, especially if something has turned sour internally and we do not find out until after we try to save a couple of hours of data file editing. It is always nice to know beforehand, sometime even vital.

The system monitor incorporates a 'DEBUG' mode. These consist of a hex memory examine and change routine, a GOTO jump routine. G command for a reboot and defined jump vectors as follows:
Bootstrap loader, init console hardware, output ACC-A data to console, input console data to ACC-A, test for char available at console, test for escape char at console, init port 1 and output ACC-A data to port 1 (aux or host device.).

SERIAL PORTS

Port 1 is configured as a DCE port (Data communications equipment). Port 2 is configured as a DTE port (Data terminal equipment). Computers and MODEMS qualify as DCE types and most other peripherals are of the DTE type. Therefore in general the number 1 port would be a printer port and the number 2 port a MODEM port. The system comes with both these ports wired and ready for your standard I/O needs. Full documentation is included for these two additionally supplied ports.

INTERNAL HARDWARE DEVICES

The internal devices are composed of the following special LSI devices, Disk controller

FD1793-B02 (Western Digital), MC6850 (3) (Motorola), SY6522 Disk and baud rate select (Synertek). The SY6522 has it's capability divided into 4 areas, serial port baud rate select and control, floppy disk unit select and control, software clock using internal timer and other unused functions available at the I/O expansion interface.

Three I/O expansion slots are available on the series 2000 CPU board for interfacing modules to the I/O bus. They consist of 10 and 25 pin connectors.

On a 64K system the memory map is defined as:

FFFF	ROM
FC80	I/O PORTS
FC00	Unpopulated if less than 64K
xxFF	System Page
xx00	MTS-6800 RAM determined by system as to size
	NODE POOL RAM default two pages
zzFF	USER TOP RAM
0100-00FE	SYSTEM PAGE POINTER
0000-00FD	USER PAGE ZERO

DOCUMENTATION

The system comes with very complete documentation. For each of the operating systems a separate manual is included. Technical diagrams and other data are available and includes the very complete Zenith operator and maintenance manuals for the video and power supply portions.

OPERATION

We have been using the series 2000 for some months now. With the exception of an IC failure (Zenith) the first day, we have experienced no failures, glitches or sub-par operation. The quality of the boards (socketed) and components is excellent and should prove to be very dependable.

The disks have performed flawlessly. However, there is one temporary disadvantage that bears mention. The early production models of the series 2000 have the disk directory written in double density format. This is a hardware design feature. The standard for the Standard S50 Bus has been a single density directory for both formats. This permits a single or double density system to access the directory. Therefore a double density system could also read and write single density. However, a single density system can not read or write a double density disk. By being double density in the directory it does preclude the transportation of disks between the series 2000 and most other 6800 systems, especially those on the Standard S50 Bus. Transportation between series 2000 computers is completely functional. However, this problem has and does exist between other Standard S50 Bus disk systems but not for this particular reason.

Wave Mate has informed us that they will change this in future production models of the series 2000. For those of us having the original double density directory format a factory modification is promised. The price is estimated to be between $25.00 and $50.00 when available.

The video is crisp and sharp with no smearing or other distortions. The relative small size of the entire system makes it very convenient for moving from desk to desk. Having the wide choice of software allows a very complete development and applications system.

CONCLUSION

We have found that all the tasks we have assigned to the Wave Mate series 2000 have been accomplished without any glitches. The quality is first class and the entire machine packs a lot of power into a compact package. Considering the depth of software available for the 6800 this machine should fill an useful and economical position in the 68XX picture. The FLEX© Disk Operating System was modified for this system by Great Plains Computer Company, Inc. (see ad this issue) and they are developing software for this system on a continuing basis. The SDOS© system by Software Dynamics allows the system a large library of applications software. This includes the Software Dynamics BASIC compiler system and text editing systems, as well as all other Software Dynamics time proven applications and other software packages. With the policy of Software Dynamics not to obsolete their applications and development packages, upgrades and conversions from 6800 to 6809, means long term usage. UCSD PASCAL© opens the door for many new applications being currently developed. For those who like to work close to the internal functions of the system the MTS-6800© real-time disk system is a natural.

Prices start at $3195.00 and for a full 64K system as reviewed with UCSD PASCAL $3450.00. Additional information can be obtained from:

Wave Mate Inc, 14009 S. Crenshaw Blvd., Hawthorne, CA 90250, (213) 978-8600, Telex 194369.

In Europe: Wave Mate International, 159 CH de Vleurgat, 1050 Brussels, BELGIUM, (02) 649-1070, Telex 24050.

BIT Bucket

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BURBANK, CALIFORNIA 91520

'68' Micro Journal
3018 Mamill Rd.
P.O. Box 849
Mixon, Tennessee 37343

Gentlemen:

We have a SWTPC DMAF-1 disk drive which we need to use with the SWTPC 809 computer, running at 1 Mhz. SWTPC has no information on such a conversion. The ideal solution would be a second control board so we could keep the present controller in our 6800 computer.

Perhaps some of your readers or advertisers could be of help.

Thank you.

Sincerely,

LOCKHEED-CALIFORNIA CO.

Marion E. Wolfe

Marion E. Wolfe
M&P Testing Engineer
Test Services Laboratory
Dept. 57-16, Bldg. 180 Plt. B-1

68 MICRO JOURNAL DISK PROGRAMS

DISK - 1: FILESORT, MINICAT, MINICOPY, MINIFMS, LIFETIME.BAS, POETRY.BAS, DIET.BAS, FOODLIST.BAS

DISK - 2: DISKEDIT, PRIME, PRMOD, SNOOPPY.BAS, FOOTBALL.BAS, HEXPAWN.BAS, LIFETIME.BAS, SPACEWAR.BAS, INSTR, DISKEDIT.REP (patches to DISKEDIT)

DISK - 3: CBUG09, SEC1, SEC2, FIND, TABLE2, NOTE, INTEXT, DISK-EXP, DISKSAVE

NOTE: All programs are as published by 68 Micro Journal with some additions or patches (if received).

This is a "READER SERVICE" only! It is made available in order to eliminate input and debugging time by 68 MICRO JOURNAL readers. No WARRANTY is given or implied for the code or program action. Please remember they are as received and published.

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INTRODUCTORY SPECIAL

To celebrate the introduction of this programming tool, we are offering it at the special price of $59.29 until November 10th, 1981.

July 25, 1981

Dear Mr. Williams,

This disk contains all the files that were used in updating cassette based DYNASOFT Pascal, version 1.2 to FLEX. The mods may not be elegant compared to what some other 6809 programmers could do, but they work. As it was, this mod was my first attempt at interfacing with the FLEX "FMS" in assembler. I also added a parallel printer driver to the package, so that the printer can be driven directly from a Pascal applications program via the SETP(3) command.

The files break down as follows:

1) DM003.PAS This is the assembler patch to change the Pascal from cassette to disk and add in a printer driver.

2) LIFE.TXT This is a Pascal program for the game of life. It is written to drive a Heathkit H-19 terminal, and would have to be modfified to run anything else.

3) CRYPTO.TXT A "formatter" for cryptoquote addicts such as myself. It has no intelligence, that would detract from my fun. Rather it makes it much easier to do letter substitutions. Again, it is written for an H-19.

In general, I have found DYNASOFT products VERY well made and documented. Al Jost has always been most cordial in conversation. I have had three versions of the Pascal. One for the 6800, and two for the 6809. In two cases I found a bug, but they were cleared up immediately. The latest version (1.3) is a real joy to use. For what has been implemented (of Pascal) I would rate the product AAA. You may publish any of or all of the programs contained on this disk. In fact, if you have a diskette copy service there, it may be convenient to offer the patches file, but that's up to you.

I really enjoy 68-Micro and hope that I might have some more offerings. Some ideas that I am working on are some memory diagnostics and some utilities written in C. I just sent in an order for Dugger's C comiler. Once the compiler is up to snuff (version 3) I rather suspect that I will be doing ALL my programming in C. I might even be so bold as to predict that with a year or two, most utilities submitted to 68-Micro will be written in the C language. I have looked at the big Pascal's and also at Fourth... but C still looks like the best. Since I program in C at work, it will also be nice to use one language for both places.

My system is all homebrew, but is mapped to look like a FLEX system. It consists of a 6809 processor, 56K of memory, two 5.25 inch floppies and and MX-80 printer. I hope to add in a 9511 math processor fairly soon, and a few more i/o channels.

Norm Commo

Ed's Note: Due to the length (over 125 sectors) of the various patches and programs it is impractical, at this time, to run the listings of Norm's fine efforts. Therefore, we will make available, at the standard disk service price (see advertising about disk service this issue) of all of Norm's work.

Please allow 2 weeks for mailing out of these disk as they will have to be special handling.

DMW —

FORMAT

The attached program, which I call FORMAT, is designed to add printer output to TSC's cassette based TEXT EDITOR. It should work also with the disk based Editor, but I suppose most who are using disk based systems would also have TSC's TEXT PROCESSOR. This little program won't begin to approach the Processor's capability, but it does enable one to generate decent hardcopy with little more than the Editor, and it doesn't cost $60.00. (The cost of the Text Processor the last time I checked)

The TSC Text Editor costs only $40.00. For this price you get the source code, object code, and a cassette for S. C. U. S. loading. Once I bought it, I paid even less (buying it directly into memory per the object listing), but I guess that (it available any longer. For the price, I can't imagine anyone willing to do without it.

I wrote the format program over a period of time. Actually, I didn't really write it, it just sort of grew. The original idea was to fool get the Editor to list output directly to a printer on a parallel port. Once that was accomplished, other enhancements followed. As it stands, format gives me the opportunity to chose the number of characters per line, to decide whether the line is to be centered, or shifted to the right or to the left, and obtain right-justified margins (most of the time). I use the program with an Epson MX-80 printer, and so I also get the various special printing modes (expanded, compressed, enhanced, etc.) that the Epson provides.

I've included both an object dump of the program, and the source listing. I'm sure many improvements can be made, and not everyone will want format located where I've put it, hence the need for the source.

Now for a few comments about how the program works. It is written assuming a printer on a parallel interface on port #7. This shouldn't be too hard to change if your system is otherwise. One enters the format program from the Editor by the command OF, patched into the Editor command set. When this command is processed, the printer is set up for double spaced lines, with a maximum of 80 characters per line. The program prompts for a format code to specify the output form. The proper response is a three digit input of the form "C40". This is interpreted by the program as centered text, with 40 (hex) characters per line. I considered trying to convert a decimal input, but it wasn't worth the trouble at the time. Maybe later. Acceptable first character inputs are C, L, and R. As long as the numerical input is less than 50 hex (80 decimal), any of the three forms C, L, or R may be used. If a line length greater than 80 decimal is required (such as when using the compressed printing mode), the R input is the only acceptable form. (Another possible improvement here.) Immediately after the third character is input, printing begins. After printing is complete, the POFF command should be given. In order to obtain single line spacing, enter the POS command immediately before the OF command.

Printout of text directly from the Editor file can be obtained by entering the PON or P20N command then the Editor command sequence "-P*" (Top of file, print to bottom of file). Listing #1 is a sample printout of a text file prepared for format printing. The line numbers may be printed or deleted by the Editor commands, but I find it more convenient to edit the text using a hard copy with line numbers. The file is basically the same as any text file, except that some special characters are required for control. These characters and their functions are summarized below:

Character	Meaning in Format
~	end of paragraph
^	stop printing to change format
\	end of text

Other characters could easily be substituted for the ones I've used, and in fact it was necessary for me to change temporarily to some other characters in order to prepare this article. Obviously, any attempt to use one of the control characters in a text would generate the function, rather than result in the printing of the character.

Listing #2 is the text as it appears when output by the format program. The characters per line and centering are user adjustable.

```
00010                          NAM     FORMAT
00020                   *
00030                   *      Program by Charlie Hoffpauir
00040                   *      2603 Perry Lane
00050                   *      Alvin, Texas 77511
00060                   *
00070                          OPT     O,NOG
00080                   *
00090 0010                     ORG     $0010
00100                   *
00110 0010 0001         TEST1  RMB     1
00120 0011 0001         TEST2  RMB     1
00130 0012 0001         TEST9  RMB     1
00140                   *
00150 0024                     ORG     $0024
00160                   *
00170 0024 0002         BOL    RMB     2
00180 0026 0002         EOL    RMB     2
00190 0028 0002         PTR2   RMB     2
00200 002A 0001         LINES  RMB     1
00210 002B 0001         LENGTH RMB     1
00220 002C 0002         OFFSET RMB     2
00230 002E 0002         ENDPNT RMB     2
00240 0030 0002         XTEMP3 RMB     2
00250 0032 0001         ADJFLG RMB     1
00260 0033 0001         ADJFL2 RMB     1
00270                   *
00280                   *  External Equates *
00290                   *
00300      0097         FILBED EQU     $0097
00310      0099         FILEND EQU     $0099
00320      0058         SPCPT1 EQU     $0058
00330      005A         SPCPT2 EQU     $005A
00340      B000         BUFFER EQU     $B000
00350      B100         BUFF2  EQU     $B100
00360                   *
00370                   * SWTBUG LOCATIONS *
00380                   *
00390      E055         BYTE   EQU     $E055
00400      E07E         PDATA1 EQU     $E07E
00410      E1AC         INEEE  EQU     $E1AC
00420                   *
00430 A200                     ORG     $A200
00440 A200 CE A31E      INSTR  LDX     #TEXTS1
00450 A 03 BD E07E             JSR     PDATA1     PRINT INSTR ON CRT
00460 A206 BD A2C4             JSR     INPUT      PICK UP FORMAT
00470 A209 DE 97               LDX     FILBEO
00480 A20B DF 58               STX     SPCPT1
00490 A20D DE 99               LDX     FILEND
00500 A20F DF 5A               STX     SPCPT2
00510 A 11 CE B000             LDX     #BUFFER    TO SET INITIAL PT OF LINE
00520 A214 DF 2E               STX     ENDPNT
00530 A216 96 2B               LDA A   LENGTH
00540 A218 9B 2F               ADD A   ENDPNT+1
00550 A21A 97 2F               STA A   ENDPNT+1
00560 A21C 7F 002A             CLR     LINES
00570                   *
00580 A21F BD A2DA      NEWLIN JSR     PTEST
00590                   *
00600 A222 DE 58        LOAD   LDX     SPCPT1     SPCPT1 HOLDS POS. IN FILE
00610 A224 5F           LOAD2  CLR B
00620 A225 A6 00               LDA A   0,X
00630 A227 08                  INX
00640 A228 81 0D               CMP A   #$0D       IS IT A CARRIAGE RET?
00650 A22A 26 10               BNE     STO1
00660 A22C 08                  INX
00670 A22D 08                  INX
00680 A22E 08                  INX
00690 A22F DF 58               STX     SPCPT1
00700 A231 20 F1               BRA     LOAD2
00710                   *
00720 A233 BD A2C4      BREAK  JSR     INPUT
00730 A236 8B 80               ADD A   #$80
00740 A238 97 2F               STA A   ENDPNT+1
00750 A23A  0 E8               BRA     LOAD2
00760                   *
00770 A 3C 81 7E        STO1   CMP A   #'~        ~ For end of paragraph
00780 A23E 27 5A               BEQ     ENDPAR
00790 A240 81 2E               CMP A   #$2E       2E=.
00800 A242 27 15               BEQ     PERIOD
00810                   *
00820                   * Insert ^ between ^ to change printout
00830 A244 81 5E               CMP A   #$5E       5E=^
00840 A246 27 EB               BEQ     BREAK
00850 A248 81 5C               CMP A   #'\        \ FOR END OF TEXT
00860 A24A 27 67               BEQ     DONE
00870 A24C 81 00               CMP A   #$00       Skip over nulls
00880 A24E 26 1E               BNE     STO3
00890 A250 20 D2               BRA     LOAD2
00900                   *
00910 A252 86 0A        SKLINE LDA A   #$0A
00920 A254 BD A345             JSR     PRINT1
00930 A257 20 15               BRA     STO3
00940                   *
00950 A259 E6 00        PERIOD LDA B   0,X        LOOK AT NEXT CHAR IN FILE
00960 A25B C1 20               CMP B   #$20       IS NEXT CHARACTER A SPACE?
00970 A25D 26 03               BNE     CKNUMB
00980 A25F 5F                  CLR B
00990 A260 20 0C               BRA     STO3
01000 A262 C1 39        CKNUMB CMP B   #'9        IF NOT A SPACE, SEE IF IT IS
01010 A264 2E 06               BGT     INSERT     A NUMBER (0-9).
01020 A266 C1 30               CMP B   #'0
01030 A268 2D 02               BLT     INSERT     IF NOT A NUMBER, INSERT SPACE
01040 A26   20 02               BRA     STO3
01050                   *
01060 A26C C6 20        INSERT LDA B   #$20       LOAD A SPACE IN B ACC.
01070                   *
01080 A26E DF 58        STO3   STX     SPCPT1     SAVE CURRENT POS. IN FILE
01090 A270 DE 2C               LDX     OFFSET     GET POSITION IN LINE
01100 A272 A7 00               STA A   0,X
01110                   *
01120 A274 08           LOOP3  INX                POINT TO NEXT POS. IN LINE
01130 A275 DF 2C               STX     OFFSET     POINT TO NEXT CHARACTER
01140 A277 9C 2E               CPX     ENDPNT     LOADED FULL LINE YET?
01150 A279 27 0B               BEQ     ADJUST
01160                   *
01170 A27B C1 20               CMP B   #$20       IS SPACE TO BE ADDED?
01100 A27D 26 A3               BNE     LOAD       Go for the next character
01190 A27F DE 2C               LDX     OFFSET
01200 A281 E7 00               STA B   0,X
01210 A283 5F                  CLR B
01220 A   4 20 EE               BRA     LOOP3
01 30                   *
01240 A286 09           ADJUST DEX                BACK UP TO LAST CHARACTER
01250 A287 A6 00               LDA A   0,X
01260 A289 81 20               CMP A   #$20       WAS IT A SPACE ?
01270 A28B 27 17               BEQ     DONEA
01280 A28D DF 2C               STX     OFF   T    NO, SO PLACE BACK IN FILE
01290 A28F DE 58               LDX     SPCPT1     AND LOOK FOR NEXT CHAR. BACK
01300 A291 09                  DEX
01310 A292 A7 00               STA A   0,X
01320 A294 DF 58               STX     SPCPT1
01330 A296 DE 2C               LDX     OFFSET
01340 A298 20 EC               BRA     ADJUST     LOOP UNTIL A SPACE IS FOUND
01350                   *
01360 A29A DF 58        ENDPAR STX     SPCPT1
01370 A29C 7F 0032             CLR     ADJFLG
01380 A29F 7F 0033             CLR     ADJFL2
01390 A2A2 DE 2C               LDX     OFFSET
01400 A2A4 8D 29        DONEA  BSR     SLFCR      LF & CR SETS PRINTHEAD
01410 A2A6 7D 0032             TST     ADJFLG
01420 A2A9 27 03               BEQ     SKPADJ
01430 A2AB BD A3B6             JSR     RADJST
01440 A2AE 8D 5F        SKPADJ BSR     SPRINT
01450 A2B0 7E A21F             JMP     NEWLIN
01460                   *
01470 A2B3 DE 2C        DONE   LDX     OFFSET
01480 A2B5 86 0A               LDA A   #$0A
01490 A2B7 A7 00               STA A   0,X
01500 A2B9 A7 01               STA A   1,X
01510 A2BB 86 0D               LDA A   #$0D
01520 A2BD A7 02               STA A   2,X
01530 A2BF 8D 4E               BSR     SPRINT
01540 A2C1 7E 0203             JMP     $0203      RETURN TO EDITOR
01550                   *
01560                   * FOLLOWING SUBROUTINES USED BY FORMAT PROGRAM
01570                   *
01580 A2C4 BD E1AC      INPUT  JSR     INEEE
01590 A2C7 97 11               STA A   TEST2
01600 A2C9 BD E055             JSR     BYTE
01610 A2CC 97 2B               STA A   LENGTH
01620 A2CE 39                  RTS
01630                   *
01640 A2CF 86 0A        SLFCR  LDA A   #$0A       LINEFEED
01650 A2D1 A7 00               STA A   0,X
01660 A2D3 86 0D               LDA A   #$0D       CARRIAGE RETURN
01670 A2D5 A7 01               STA A   1,X
01680 A2D7 A7 02               STA A   2,X
01690 A2D9 39                  RTS
01700                   *
01710 A2DA D6 10        PTEST  LDA B   TEST1
01720 A2DC C1 01               CMP B   #$01
01730 A2DE 27 04               BEQ     LINE1      SINGLE SPACE ONLY
01740 A2E0 86 0A               LDA A   #$0A
01750 A2E2 8D 61               BSR     PRINT1
01760 A2E4 96 11        LINE1  LDA A   TEST2      CK TO DET FORMAT (C,L,R)
01770  2E6 81 52               CMP A   #'R
01780 A2E8 27 02               BEQ     CPRNT
01790 A   A 20 0B               BRA     CORL
01800 A2EC CE B000      CPRNT  LDX     #BUFFER
01810 A2EF DF 2C               STX     OFFSET
01820 A2F1 8D 41               BSR     CLRBUF
01830 A2F3 7C 0032             INC     ADJFLG
01840 A2F6 39                  RTS
01850                   *
01860 A2F7 C6 50        CORL   LDA B   #$50       LOAD 80 DEC.
01870 A2F9 D0 2B               SUB B   LENGTH     80-L = B
01880 A2FB 27 EF               BEQ     CPRNT
010 0 A2FD 81 43               CMP A   #'C
01900 A2FF 26 01               BNE     CONTC
01910 A301 57                  ASR B
01920 A302 86 20        CONTC  LDA A   #$20
01930 A304 5A           1SCL1  DEC B
```

```
01940 A305 37           PSH B
01950 A306 BD 3D        BSR    PRINT1
01960 A309 33           PUL B
01970 A309 C1 00        CMP B  #$00
01980 A30B 27 DF        BEQ    CPRNT
01990 A30D 20 F3        BRA    INCLI
02000                   *
02 10                   *
02020 A30F CE 0000 SPRINT LDX  #BUFFER
02030 A312 A6 00   LOOPS  LDA A 0,X
02040 A314 BD 2F        BSR    PRINT1
02050  316 01 0D   SKIP3  CMP A #$0D
02060 A318 27 03        BEQ    SPOUT
02070 A31A 08           INX
02080 A31B 20 F5        BRA    LOOPS
02090 A31D 39           SPOUT  RTS
02100                   *
02110 A31E 10           TEXTS1 FCB    $10,$16  HOME UP & CLEAR
02120 A320 4C           FCC    /LINE FORMAT (HEX)/
02130 A331 0A           FCB    $0A,     $00
02140 A333 04           FCB    4
02150                   *
02160 A334 36           CLRBUF PSH A
02170 A335 37           PSH O
02180 A336 4F           CLR A
0219  A337 C6 50        LDA B  #$50
02200 A339 A7 00   BSTORE STA A 0,X
02210 A33B 08           INX
02220 A33C 5A           DEC B
02230 A33D 26 FA        BNE    BSTORE
02240 A33F 32           PUL A
02250 A340 33           PUL B
02260 A341 CE 8000      LDX    #BUFFER
02270 A344 39           RTS
02280                   *
02290                   *
02300 A345 81 0A   PRINT1 CMP A #$0A
02310 A347 26 0E        BNE    NOTLF
02320 A349 D6 2A        LDA B  LINEB
02330 A34B C1 39        CMP B  #$39      157 DEC.=58 LINES/PAGE)
02340 A34D 26 05        BNE    NOTF1N
02350 A34F BD 09        BSR    SENDFF    SEND FORM FEED
02360 A351 D7 2A        STA B  LINEB
02370 A353 39           RTS
02380 A354 7C 002A NOTF1N INC  LINEB
02390 A357 BD 0A   NOTLF  BSR  PDELAY
02400 A359 39           RTS
02410                   *
 2420 A35A 36           SENDFF PSH A
 2430 A35B B6 8C   LOOP8  LDA A #$8C      HEX 8C 18 FORM FEED
02440 A35D  D A363      JBR    PDELAY
02450 A360 3F           CLR B
02460 A361 32           PUL A
02470 A362 39           RTS
02480                   *
02490 A363 DF 30   PDELAY STX  XTEMP3     SAVE IXR
02500 A365 CE 801C      LDX    #$801C    SET FOR PORT #7
02510 A368 5F           CLR B
02520 A369 E7 01        STA B  1,X
02530 A36B C6 FF        LDA B  #$FF
02540 A36D E7 00        STA B  0,X
02550 A36F C6 04        LDA B  #$04
02560 A371 E7 01        STA B  1,X
02570 A373 A7 00        STA A  0,X       OUTPUT CHARACTER TO PRINTER
02580 A375 C6 36        LDA B  #$36
02590 A377 E7 01        STA B  1,X
02600 A379 C6 3E        LDA B  #$3E
02610 A37B E7 01        STA B  1,X       SEND STROBE TO PRINTER
02620 A37D E6 01        LDA B  1,X
02630 A37F 2A FC        BPL    *-2
02640 A381 A6 00        LDA A  0,X
02650 A383 DE 30        LDX    XTEMP3
02660 A385 39           RTS
02670                   *
02680 A386 DE 2E   ADJUST LDX  ENDPNT
02690 A388 DF 26        STX    EOL
02700 A38A CE 0000      LDX    #BUFFER
02710 A38D DF 24        STX    BOL
02720 A38F DE B100      LDX    #BUFF2
02730  392 DF 28        STX    PTR2
02740 A394 96 2F        LDA A  ENDPNT+1
02750 A396 90 2D        SUB A  OFFSET+1
02760 A398 16           TAB                 B ACCUMULATOR HOLDS COUNT
02770 A399 73 0033      COM    ADJFL2
02780 A39C 7D 0033      TST    ADJFL2
02790 A39F 27 1B        BEQ    LBP
02800                   *
02810 A3A1 5D      RSP    TST B
02820 A3A2 27 5E        BEQ    DONERJ
02830 A3A4 DE 2C        LDX    OFFSET
02840 A3A6 A6 01        LDA A  1,X
02850 A3A8 09           DEX
02860 A3A9 DF 2C        STX    OFFSET
02870 A3AB DE 26        LDX    EOL
02880 A3AD B1 20        CMP A  #$20      Check to see if it's a space
02890 A3AF 26 04        BNE    SKPR
02900 A3B1 A7 01        STA A  1,X
02910 A3B3 09           DEX
02920 A3B4 5A           DEC B
02930 A3B5 A7 01   SKPR  STA A  1,X
02940 A3B7 09           DEX
02950 A3B8 DF 26        STX    EOL
02960 A3B  20 E5        BRA    RSP
02970                   *
02980 A3BC 5D      LBP   TBT B
02990 A3BD 27 43        BEQ    DONERJ    If B=0 initially, no adj. req
03000 A3BF DE 24   LBLOOP LDX  BOL       Start of the line
03010 A3C1 09           DEX
03020 A3C2 09           DEX
03030 A3C3 9C 2E        CPX    ENDPNT
03040 A3C5 27 19        BEQ    DONERJ
03050 A3C7 A6 02        LDA A  2,X       Load 1st. letter of line
03060 A3C9 7C 0025      INC    BOL+1
03070 A3CC DE 28        LDX    PTR2
03080 A3CE 5D           TBT B
03090 A3CF 27 08        BEQ    SKPL
03100 A3D1 B1 20        CMP A  #$20
 3110 A3D3 26  4        BNE    SKPL
 3120 A3D5 A7 00        STA A  0,X
03130 A3D7 08           INX
03140 A3D8 5A           DEC B
03150 A3D9 A7 00   SKPL  STA A  0,X
03160 A3DB 08           INX
03170 A3DC DF 28        STX    PTR2
03180 A3DE 20 DF        BRA    LBLOOP
03190                   *
03200                   * Now switch from BUFF2 to BUFFER
03210                   *
03220 A3E0 CE 8000 DONERJ LDX  #BUFFER
03230 A3E3 C6 03        LDA B  #$3
03240 A3E5 DB 27        ADD B  EOL+1
03250 A3E7 D7 27        STA B  EOL+1
03260 A3E9 DF 24        STX    BOL
03270 A3EB CE B100      LDX    #BUFF2
03280 A3EE DF 28        STX    PTR2
03290 A3F0 DE 28   SWLOOP LDX  PTR2
03300 A3F2 A6 00        LDA A  0,X
03310 A3F4 08           INX
03320 A3F5 DF 28        STX    PTR2
03330 A3F7 DE 24        LDX    BOL
03340 A3F9 A7 00        STA A  0,X
03350 A3FB 08           INX
03360 A3FC DF 24        STX    BOL
03370  3FE 9C 26        CPX    EOL
03380 A400 26 EE        BNE    SWLOOP
03390                   *
03400 A402 39      DONERJ RTS
03410                   *
03420                   ************************
03430                   *  PATCHES FOR EDITOR  *
03440                   ************************
03450                   *
03460 0206                 ORG    $0206
03470                   *
03480 0206 7E E1F6 INCHB   JMP    $E1F6    Enable 8-BIT input
03490 0209 7E 14A1 OUTCH   JMP    PRPTCH   Patch Character out
03500                   *
03510                   * New Commands
03520                   *
03530 0214                 ORG    $0214
03540                   *
03550 0214 41      TABLE   FCC    /A/  Replace 'APPEND' with 'A'
03560 0215 00              FCB    0
03570 0216 12D0            FDB    $12D0
03580                   *
03590 0218 42              FCC    /B/  Replace ''BOTTOM' with 'B'
03600 0219 00              FCB    0
03610 021A 098E            FDB    $098E
03620                   *
03630 021C 43              FCC    /C /  Replace 'COPY' with 'CD'
03640 021E 00              FCB    0
03650 021F 0FF3            FDB    $0FF3
03660                   *
03670 0221 50              FCC    /PON/  Add new command Print On
03680 0224 00              FCB    0
03690 0225 1492            FDB    PRON
03700                   *
03710 0227 50              FCC    /P2ON/  Add new command for dble spac
03720 0220 00              FCB    0
03730 022C 1496            FDB    PR2ON
03740                   *
03750 022E 50              FCC    /POFF/  Add new command Print Off
03760 0232 00              FCB    0
03770 0233 149A            FDB    PROFF
03 80                   *
 3790 0235 43              FCC    /C/  Replace 'CHANGE' with 'C'
03000 0236 00              FCB    0
03810 0237 00CB            FDB    $0DC9
03820                   *
03830 0239 47              FCC    /GF/  Add Go Format command
03840 023B 00              FCB    0
03850 023C A200            FDB    INSTR
03860                   *
03870                   * Revise file start
03880                   *
03890 0359                 ORG    $0359
03900                   *
03910 0359 14C0            FDB    $14C0    New starting point for file
03920                   *
03930                   * Printer line spacing
03940                   *
03950 1492                 ORG    $1492
03960                   *
03 70 1492 C6 01   PRON    LDA B  #$01
03980 1494 20 06           BRA    PSTO
03990 1496 C6 02   PR2ON   LDA B  #$02
04000 1498 20 02           BRA    PSTO
04010 149A C6 00   PROFF   LDA B  #$00
04020 149C D7 10   PSTO    STA B  $10
04030 149E 7E  383         JMP    $0383
04040                   *
04050                   * Character Output Patch
04060                   *
04070 14A1 37      PRPTCH  PSH B
04080 14A2 D6 10           LDA B  $10
04090 14A4 C1 00           CMP B  #$00
04100 14A6 27 05           BEQ    NOTPR
04110 14A8 BD A363         JSR    PDELAY
04120 14AB 33              PUL B
04130 14AC 39              RTS
04140 14AD 33      NOTPR   PUL B
04150 14AE 7E E1D1         JMP    $E1D1    Output to CRT only
04160                   *
04170                      END

TOTAL ERRORS 00000
```

```
*      Hex Dump of Format Object
*
A200 CE A3 1E 80 E0 7E  D A2 C4 DE 97 DF 58 DE 99 DF
A210 5A CE B0 00 DF 2E 96 2B 9B 2F 97 2F 7F 00 2A BD
A220 A2 DA DE 58 5F A6 00 08 81 0D 26 10 08 08 08 DF
A230 58 20 F1 BD A2 C4 8B 80 97 2F 20 E8 81 7E 27 5A
A240 81 2E 27 15 81 5E 27 EB 81 5C 27 67 81 00 26 1E
A250 20 D2 86 0A BD A3 45 20 15 E6 00 C1 20 26 03 5F
A260 20 0C C1 39 2E 06 C1 30 2D 02 20 02 C6 20 DF 58
A270 DE 2C A7 00 08 DF 2C 9C 2E 27 08 C1 20 26 A  DE
A280 2C E7 00 5F 20 EE 09 A6 00 81 20 27 17 DF 2C DE
A290 58 09 A7 00 DF 58 DE 2C 20 EC DF 58 7F 00 32 7F
A2A0 00 33 DE 2C 8D 29 7D 00 32 27  3 BD A3 86 8D 5F
A2B0 7E A2 1F DE 2C 86 0A A7 00 A7 01 86 0D A7 02 BD
A2C0 4E 7E 02 03 BD E1 AC 97 11 BD E0 55 97 2B 39 86
A2D0 0A A7 00 86 0D A7 01 A7 02 39 D6 10 C1 01 27 04
A2E0 86 0A 8D 61 96 11 81 52 27 02 20 0B CE 80 00 DF
A2F0 2C 8D 41 7C 00 32 39 C6 50 00 2B 27 EF 81 43  6
A300 01 57 86 20 5A 37 8D 3D 33 C1 00 27 DF 20 F5 CE
A310 B0 00 A6 00 BD 2F 81 0D 27 03 08 20 F5 39 10 16
A320 4C 49 4E 45 20 46 4F 52 4D 41 54 20 2B 48 45 58
A330 29 0A 0D 04 36 37 4F C6 50 A7 00 08 5A 26 FA 32
A340 33 CE B0 00 39 81 0A 26 0E D6 2A C1 39 26 05 BD
A350 09 D7 2A 39 7C 00 2A BD 0A 39 36 B6 BC BD A3 63
A360 5F 32 39 DF 30 CE B0 1C 5F E7 01 C6 FF E7 00 C6
A370 04 E7 01 A7 00 C6 36 E7 01 C6 3E E7 01 E6 01 2A
A380 FC A6 00 DE 30 39 DE 2E DF 26 CE B0 00 DF 24 CE
A390 B1 00 DF 2B 96 2F 90 2D 16 73 00 33 7D 00 33 27
A3A0 1B 5D 27 5E DE 2C A6 01 09 DF 2C DE 26 B1 20 26
A3B0 04 A7 01 09 5A A7 01 09 DF 26 20 E5 5D 27 43 DE
A3C0 24 09 09 9C 2E 27 19 A6 02 7C 00 25 DE 2B 5D 27
A3D0 08 81 20 26 04 A7 00 08 5A A7 00 08 DF 2B 20 DF
A3E0 CE B0 00 C6 03 DB 27 D7 27 DF 24 CE B1 00 DF 2B
A3F0 DE 2B A6 00 08 DF 2B DE 24 A7 00 08 DF 24 9C 26
A400 26 EE 39 01 01 01 01 01 01 01 01 01 01 01 01 01
*
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         Patches for TSC Editor
*
0200 7E 03 55 7E 03 B3 7E E1 F6 7E 14 A1 7E 02 03 7E
0210 E1 D1 7F FF 41 00 12 DD 42 00 09 BE 43 4F 00 0F
0220 F3 50 4F 4E 00 14 92 50 32 4F 4E 00 14 96 50 4F
0230 46 46 00 14 9A 43 00 0D CB 47 46 00 A2 00 A3 B0

0250 49 4C 45 3A 04 8E 01 FF CE 14 D0 DF 97 DF 99 CE

1490 D3 FF C4 01 20 06 C4 02 20 02 C6 00 D7 10 7E 03
14A0 83 37 D6 10 C1 00 27 05 BD A3 63 33 39 33 7E E1
14B0 D1 7E E1 D1 BD C9 70 7E 02 03 01 01 01 01 01 01
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THOSE WONDERFUL MEMORY-MAPPED VIDEO BOARDS

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One of the most important decisions facing the home computer user is the choice of an appropriate video terminal. Probably at least ninety-percent of the time spent at the computer will be done staring into the CRT. This is also the showcase for the un-initiated. Family and friends will judge the relative "value" of a home computer based on what they see on the screen. Like it or not, we must all become salesmen occasionally, if we want the home computer industry to grow.

Until recently, the choices for the 68XX user were limited to serial terminals. Unfortunately, the serial terminal adds a disproportionate cost onto the system -- especially when compared to mass-produced, all in a box computers. Also, serial terminals are usually limited to as-purchased features. Drastic changes to the format or attributes are, at best, difficult if not impossible. A serial terminal was intended primarily for multiuser systems and systems where the CPU was physically distant from the user. This is not the case with most home systems, and we would like to minimize the impact of these basic problems.

To answer these problems, several manufacturers have combined CRT Controller integrated circuits with the concept of memory-mapping and have developed products that rival the performance of high cost terminals -- at a fraction of the price. One of the best features of this new breed of boards is their relative flexibility. Many of the features that were once considered to be hardware fixed are now directly under the control of software.

MEMORY-MAPPED VIDEO -- THE CONCEPT

The CRT output circuitry of every serial terminal contains something called a screen memory. This is ordinary RAM that contains an "image" of the text to be displayed on the CRT -- one byte for every character on the display. There is also some control logic that acts as a traffic cop for the rest of the system. It takes character data from the computer and, at the appropriate time, sticks them into the proper screen memory locations. It keeps track of the cursor, does scrolling and other visual attributes, plus generates all the timing, video and sync signals necessary to drive the CRT. While doing all this, the control logic must also provide addresses to the screen memory and character generating logic so that the proper sequence of data (or pixels) can be formed on the screen.

Regardless of what contortions the terminal must go through, the sole objective of the CPU is to get a byte of data into the proper place in the screen memory. Built into 68XX microcomputers is an ultimately simple method for doing just this : LDA and STA instructions! In order to use these instructions, the screen memory must physically consist of RAM and be on the buss, addressable by the CPU. Thus we have now represented (mapped) screen memory as memory within the address space of the CPU.

There is one other immediate problem: the control logic also needs to address this portion of memory. To solve this, multiplexers are placed on the screen memory address and data lines. Memory contention logic must now be designed to resolve which one gets access to the memory -- the CPU or the control logic. This is not a trivial task and can lead to some very undesirable results if not properly handled.

CRT CONTROLLER I.C.'S

To construct the functions necessary to generate video output, it may take between 60 and 100 ordinary TTL chips. This chip count has been considerably reduced by CRT Controller (CRTC) chips that combine many of the necessary functions. SS - 50 Buss manufacturers have designed complete video boards using either the MOTOROLA 6845 or the SMC 5027. Thus discussion will be limited to these chips. For reference, other chips in this category include the DP8350 (NATIONAL SEMICONDUCTOR), the 8275 (INTEL), and the 6545 (SYNERTEK).

To a great extent the design of the board, the functions that are available to the user, and their ease of use is dictated by the particular CRTC that is chosen. Some insight can be gained by first looking at the individual functions of the 6845 and the 5027 at the chip level. Refer to Table 1 which summarizes the salient features and to Figure 1 which is a general block diagram of a CRTC Video Board.

In figure 1, all functions outside of the CRTC block must be provided by the video board designer. Within the block there are two other major differences : (1) the 6845 provides for directly connecting a light pen while the 5027 does not, and (2) the 5027 provides a programmable pipeline delay, a delay necessary to properly phase the video data with the blanking and cursor signals. 6845 users must provide this delay with external circuitry.

The remainder of the logical functions within the CRTC block are provided by both chips. But some of these functions have significant differences in their versatility and operation. For example, the 5027 has only a block cursor with no blinking capability. The 6845 has two blink rates, plus any portion of the cursor block can be filled in, by software, a raster line at a time.

The programmable registers can be roughly divided into two categories: format and timing registers, which are usually loaded once during initialization and operating registers, which may be frequently accessed and manipulated during operation. The 5027 requires less format and timing register space due to its smaller display format range. This is not really a disadvantage, as it is difficult to imagine anyone wanting to build an alphanumeric display that exceeds a 132 x 64 format. The 6845 has more operating registers due to the additional cursor and light pen features.

Memory addressing in the 6845 is linear, that is, all display locations are assumed to be a continuous string of memory. As far as software is concerned, this is not always the most efficient method. For example, when trying to implement a screen-oriented editor, functions such as insert/delete lines and characters are often considerably easier to code if the memory is organized on a column/row basis as in the 5027. The disadvantage to the column/row approach is that it is accomplished at the cost of memory usage efficiency (unless the line and row lengths happen to be a power of two).

Another feature that is now becoming increasingly popular in high line terminals is the so-called "soft scroll". This is where text scrolling is done on a raster line at a time basis giving a very pleasing roll up effect instead of jumping a line at a time. For users of the 5027, SMC has written an application note describing a simple circuit that can be added to provide soft scrolling. Unfortunately, this feature was not implemented on any of the SS-50 boards that used the 5027. I know of no easy way to implement this feature with the 6845.

It is also worth mentioning that the 5027 has a self loading feature which, at restart, will load all format and timing registers from an external PROM. This feature was primarily intended for terminals that lacked CPU support. When this feature is used the programmer no longer has control over the format and timing registers.

THE VIDEO BOARDS -- GENERAL OPERATION

At present, there are four memory-mapped video boards available for the SS-50 Buss that utilize a CRT Controller IC. Table II is a comparison chart that outlines the pertinent hardware features of each board. While this chart is far from perfect, it will serve as a starting point for discussing the features and capabilities of each board.

The general setup and operation with any of the four video boards is essentially the same. After address selection is made, the video board simply plugs into one of the 50-pin slots on the buss. The only external connection is a user-supplied cable and connector to the CRT monitor's video input. Remember, the board functions as an output device only -- no hardware is provided for keyboard input. It is up to the user to provide a keyboard, a keyboard input port, and a compatable character input routine.

Assuming the appropriate software is in place, a short initialization routine is activated upon power up. This is where the screen and cursor format is defined and the other CRTC registers brought to initial conditions. At this time the screen is also usually cleared and the system monitor program starts up, displaying a prompt character.

A special video character output routine, replacing OUTEEE, now handles all writing to the screen and control functions. This is where the flexibility of the video boards really begins to shine. This routine can be written to emulate almost any terminal in town, from the dumbest right on up to the most intelligent. The video output routine is, of course, merely a convenience as it does all the mundane bookkeeping of cursor position, scrolling, etc. There is no good reason why an applications program cannot bypass this routine and load data directly into memory.

Used in this manner, a full - fledged terminal has now been emulated with a video board. At this point, the biggest difference the user will observe is the blinding speed of the display operation. It goes so fast that you will probably want to insert a delay until you get used to it.

HARDWARE

All of the boards come assembled and tested with the exception of the F & D version, which is bare board and documentation only. Each board was well laid out and constructed, and also presented a very good visual appearance. The F & D board is about 1/4 inch wider and higher than "standard" SS-50 size. The others were the usual dimensions.

Percom sockets nine of the larger chips, but flow solders the rest of the components to the board. Gimix and Smoke Signal Broadcasting (SSB) socket all of the chips, and they even add a socket for the video cable. These two boards also have a green epoxy solder mask and gold plated buss connectors ... SSB even goes so far as to silk screen the component side of the board with all of the component labels. Quality Control was apparently on the ball, too, for I could not detect a single manufacturing flaw in any of the boards I examined.

THE CHARACTER CLOCK COMPROMISE

About the only thing that is not programmable on the boards is the character clock rate. The character clock is the amount of time allotted, per character, during horizontal retrace. In other words, this determines the width of each character plus any space in between characters. It is obtained by dividing down the dot clock (which clocks out the individual pixels).

Eight dot clocks wide is a convenient choice for a character clock if one also wishes to use a graphics character generator. In this way, one byte can be clocked out in graphics mode and not leave blank spaces between characters on the screen. Both Gimix and SSB do this, using a character cell size of 8 x 10 (8 pixels wide by 10 raster lines deep) in which they place a 5 x 7 character. The characters, of course, are not as well defined as the more dense 7 x 9 character generator would produce. However, it is the overall appearance of the display that really counts, and a 5 x 7 character inside an 8 x 10 cell produces a total result that is quite pleasing to the eye and very readable.

F & D has opted to design in more character definition with a 7 x 9 character placed inside an 8 x 12 cell. To my eye, this method does not leave enough space between characters. Also, the Aspect (height to width) Ratio, in non-interlaced mode, deviates too far from "normal" to give a comfortable effect. However, when I connected this board into a very high quality monitor and used the interlaced mode, the display was considerably improved and quite acceptable. Then again, this effect may not bother you in the slightest.

Meanwhile, Percom has also decided to use a 7 x 9 character generator. But notice that each character is placed in a larger 10 x 14 cell size. This results in probably the nicest looking alphanumeric display of all. Well defined characters combined with the wider spacing total up to an outstanding display. To accomplish this, unfortunately, a couple of sacrifices had to be made. First, the larger cell size limits the display to about 80 x 16 in the non-interlaced mode. Second, in order to fill up a 10 wide cell with 8 graphics bits, the bits had to be doubled up. In the character graphics mode only the first five bits are used each bit being clocked out twice. This effectively cuts down on the horizontal resolution. A small price to pay if you are predominately interested in an alphanumeric display.

While the character cell width is fixed by the hardware, the height of each cell is programmable. You can add spaces between each line on the display in increments of one scan line. The minimum height of a character cell will be determined by the particular character generator used.

Going back to the horizontal format for a moment, there is one other subtlety worth mentioning. Once the horizontal dot clock frequency is chosen, this automatically fixes the maximum line length. For example, suppose we initialize the board for an 80 x 24 format and then, for some reason, we wish to change this to, say, 64 x 16. We can certainly do this, but what happens to the line length? The line length, being fixed, is still 80 characters or so long but only 64 of them are displayed. We do not get 64 characters spread out into the same space that the 80 characters used to take up! In order to do that, we must change the dot clock crystal.

THE OVERWORKED BIT

To display a character in normal operation, it is only necessary to store the ASCII code for that character into the appropriate location in screen memory. As ASCII is only a seven bit code, this leaves one bit laying around to play with. The common approach taken by F & D, SSB, and Percom is to use this extra bit to control graphics mode OR visual attributes on a character by character basis. Thus you can, via hardware jumpers, opt for the ability to select either the Graphics ROM, inverse video, or half intensity simply by setting the eighth bit in the ASCII character. Note that once one of these options is selected, the other two are not available.

Gimix had a slightly more complex problem to resolve. The three different character generators, plus inverse video and half intensity, on their board could not be selected with just one bit. So, while the other manufacturers took the straightforward design approach, Gimix had to devise an alternate method to program the board.

THE GIMIX "CONTROL PORT" CONCEPT

In a "standard" design approach, the CRTC registers are just placed on the buss and given an address, thus allowing the programmer direct access to the chip. Gimix, however, designed in a four address Control Port between the CRTC and the SS-50 Buss lines. All control and attribute functions are programmed through this four byte Control Port; the user does not have direct access to the CRTC registers.

Control Port 0 is the control register with each bit serving a unique function. Some of the functions are enable/disable the memory, select mode, blank the display, and turn cursor on, off, or blink/steady (Gimix added a cursor flashing circuit to their board). Bit 7 of Port 0 has a nice feature -- it is high during vertical retrace time. The CPU can poll this bit allowing screen updates with no splatter.

Control Port 1 is a dual purpose register, its function set by bit 2 of Port 0. During normal operation, it will be selected as the scroll register. Its other function is what Gimix has termed the "Mode Programming Port". Through this port an onboard 16 byte RAM is loaded. This allows the user to preprogram up to 16 unique combinations for attribute and character generator selection (instead of just one). The combinations are then triggered depending upon which "group" the ASCII character falls into (control, numeric, upper or lower case), and which "slot" (the seventh ASCII bit).

Ports 2 and 3 are the X,Y position of the cursor. Gimix has included two pages of charts that completely define the function and programming of all four ports.

While the Gimix Control Ports handle the usual operating register functions, what about the format registers? It seems that Gimix has taken advantage of the self programming feature of the 5027 CRTC. They have added a special PROM (no info included) to automatically load the format registers on power up/reset. Thus, the user no longer has control of the screen format -- it comes up 80 x 24 until a different PROM is installed. So be sure that your monitor can handle an 80 x 24 format, if you elect to buy the Gimix board.

THE MEMORY CONTENTION PROBLEM

As was noted before, the CRTC must continuously address the screen memory to provide refresh data for the display. It would also be nice if the CPU could write to the screen memory as the new characters could be displayed. Multiplexers on the address lines prevent the obvious failure from occuring. But now the big question becomes -- when do we switch the multiplexers?

If the designer calmly goes ahead and says the CPU always gets priority, then a very sticky problem occurs. Suppose the processor decides to update memory during an active raster scan, when the screen really needs data from the screen memory to maintain refresh. The muxes are switched and now the wrong data (as far as the screen is concerned) appears on the buses! Result? The wrong data gets clocked out and a very annoying snow effect splatters the screen. This is also called, among other things, access flicker.

There are a couple of things a designer can do to alleviate this effect: first, a latch can be added on the data buss between the screen memory and the character generator. This will insure that the correct data will stay put for at least one character time. This usually helps but is not, in itself, sufficient. The next step is to provide a circuit that actually blanks the screen during CPU access times (this ends up happening for only a small portion of one raster line). The rationale being that no data is better than the wrong data, which turns out to be entirely valid.

Percom, SSB, and Gimix all attack the problem in this manner. I viewed the display generated by each of these boards under various CPU access conditions and could detect no appreciable splatter on the screen. F & D, however, did not take either of the precautions. As a result, considerable flicker appears on the screen. Fortunately, there is a rather simple addition that can be made to almost completely eliminate the problem. The necessary modifications are outlined in Figure 2.

Another way to avoid any flicker is to give the CPU priority but only update the screen memory during the vertical retrace periods. This slows the CPU down somewhat, but it is certainly a viable solution for alphanumeric applications. Gimix has the only board that brings the retrace signal out to the buss.

The best solution to the problem is to take advantage of the two-phase clock generated by 68XX systems. The trick is to let the CRTC address the screen memory on one phase and let the CPU see the other phase. Total transparency is thus achieved. The main drawback to this method is that it requires the CPU clock to be synchronized with the CRTC clock. Apparently the problem is economically insurmountable -- nobody uses it.

DOCUMENTATION

Along with the video board, each manufacturer provides a User's Guide. These manuals cannot possibly include complete information on all aspects and applications of memory-mapped video boards. Nonetheless, they all provide sufficient information to successfully get up and running. In content and readability, I found all of them to be roughly on par.

A schematic and parts list is included with each manual with SSB and F & D also adding a short circuit description. F & D, being the only non-assembled board, comes with two pages of brief assembly instructions.

SOFTWARE

Any of the video board hardware, of course, is completely helpless without software to back it up. As a bare minimum you will need an initialization routine and a character output routine. On power up or reset, the initialization routine programs all the CRTC registers and starts you out in the home position with a cleared screen. The character output routine takes the place of OUTEEE -- it displays any printable ASCII character on the screen, moves the cursor appropriately, and handles scrolling the display. It also must be able to recognize and respond to at least the most common control characters. All manufacturers provide, with some minor variations, at least one good example of each of these routines.

What remains to be done now is to patch these routines into your existing operating system. Usually this will mean burning a new EPROM that has been rewritten to include these routines -- or at least reorder addresses appropriately. I rewrote the output routine to include a lookahead command jump table. I can now load additional functions into RAM as the need arises.

As mentioned before, one real forte of video boards is that their functions can be dramatically altered simply by adding the appropriate program. To demonstrate this, the manufacturers have included some clever examples of additional functions that can be added to the basic program.

F & D, for example, adds an escape sequence to their character output routine that includes some rather nice graphics commands. It is designed to work around their optional graphics EPROM which contains enough special characters to emulate TRS-80 graphics (128 x 48 block resolution). Using about 550 additional bytes, they have added commands to set, reset, or invert any block by inputting X, Y coordinates and a routine to draw a line between any two X, Y points. They have also included a short joy stick input routine for the onboard PIA. At additional cost, F & D has available a program they call FADDUC-11MS. This is a completely MIKBUG compatable monitor with video drivers included. It fits very comfortably into a 2716 EPROM and can be plugged right into the SWTPC MP-A2 processor board.

Percom includes their WINDEX program which, as written, will emulate an elementary terminal in an 80 x 16 format. As a demonstration, Percom also includes Cliff Reshing's version of the now famous "Game of Life". It requires less than 3k of memory and it takes about six seconds per generation (6800 version).

Smoke Signal Broadcasting has come up with what is easily the most extensive video driver of all. In addition to the bare-bones necessities, they have written 16 escape sequences and control character functions that really begin to show the potential of programmable video boards. There are 15 escape sequences and 10 control character commands. Some of the more notable are:

- Set or clear a protected field on the screen.
- Position the cursor to any X, Y location.
- Read character at the cursor position.
- Set a delay count to allow any desired scroll rate.
- Turn graphics characters on/off.

The smiley program comes already installed in an onboard 2708 EPROM. All you have to do is vector to it.

The Gimix board comes with a 450 byte listing of their Stand Alone Video Driver (SVD). As is, this program provides the basic terminal functions with a couple of interesting features. The "bell" control character toggles a latch at a programmable rate. The latch can be hooked up to a speaker to provide an audible beep. Their KEYIN input routine also has a novel twist: The cursor is normally off -- calling this routine turns the cursor on, calls INEEE, turns the cursor off, and then returns.

Gimix's biggest contribution, however, is an outstanding program called MAKECHAR. This is a 4k interactive program for creating character sets for use on their programmable character generator. This program is cursor based with 21 commands that allow one to easily design and edit any special character. A program of this type is almost indispensible for any serious work with a programmable character generator.

Unfortunately, Gimix does not include any example programs to illustrate the potential use of their unique Control Ports. I think this area deserves a couple of clever demonstration programs to tickle the user's imagination.

GRAPHICS CAPABILITIES

The "Graphics Mode" feature claimed by each manufacturer is really a misnomer. None of the boards are capable, as is, of producing a pixel controlled graphics display. What they do produce is more aptly termed semigraphics or block graphics.

In a pixel graphics display, one bit in screen memory is used to control one pixel on the screen. However, all of the boards described here are orientated towards alphanumeric displays (in which character generator logic assumes responsibility for making the individual pixels). This considerably limits user control over the display area. At this point, the best that can be done is to define another character set that contains a set of special shapes and figures. The shape can be any combination of dots inside the basic character cell. With a cleverly designed character set and a little imagination, some amazing things can be done with a semigraphics mode.

F & D, Percom, and Gimix all include steering logic and space for an optional EPROM character generator. You can select between the two on a character-by-character basis, thus allowing alphanumerics and semigraphics simultaneously. SSB chose to combine the ASCII and special character generators into one EPROM. A 2716 comes standard on their board -- it contains 96 ASCII characters and 32 special graphics figures. That same socket can also be jumper configured to accept a 2732 (not supplied) which accounts for the SSB claim of 256 character capability.

Unfortunately, no matter how carefully you design a special character set, Murphy says that the next program you write will require at least one character that you do not have. Gimix has solved this problem by also including a 2k programmable character generator. With 2k,128 special symbols can be created at a time. In my opinion, this outstanding feature should become a standard for any video board.

THE CRT MONITOR

Here is where the proverbial "weak link" will become most obvious. Even the best designed video board cannot completely overcome the inherent deficiencies in a low-line CRT monitor. The larger format, professional-looking displays that these video boards are capable of producing will require commensurate performance from the CRT monitor. Marginal bandwidth, low persistance phosphor, poor vertical and horizontal linearity, and uneven focus are all factors of the CRT that can add up to a disappointing end result.

As display appearance is quite subjective, you should decide for yourself what is acceptable and what is not. If you already own a low-line monitor be prepared to accept some compromises in display format. With most of the video boards, you can simply reprogram a larger format if and when you upgrade to a better CRT monitor. If you are about to purchase a monitor, I suggest that you do not pinch pennies in this area. If at all possible arrange to see a demonstration before you buy.

INTO THE BACKSTRETCH

In this article, I have presented an overview starting with serial terminals and proceeding through CRTC's and the memory-mapped video concept. For now the overview had to stop with a look at some of the presently available hardware. In the larger sense, any one of the video boards will produce approximately the same results when used in alphanumeric terminal applications. Thus, I zeroed in only on the differences among the boards. Some of these, admittedly, were only fine shades of differences, or highly subjective differences.

After digesting everything up to this point, the ultimate question must now be posed -- "Which one do I buy?". If the technical aspects have not already answered this question for you, other factors such as cost, manufacturer's credibility, reliability and personal preference, etc., must be used to tip the scale. So, to wrap up this part of the article, I will plunge in head first and offer some of my personal observations on each board.

F & D represents the clear cut choice for those on a limited budget and with an insatiable lust for tinkering. Some clever shopping can bring this board home for around $150. But remember this is parts cost alone -- you will still have a considerable time investment in procuring parts, assembly, and checkout. If you goof, it will cost you at least an additional $40 to have F & D straighten out your indiscretions. It is a little rough around the edges, but it works just fine. Cottage industries do not usually have the advantages inherent in a full-time company that are necessary to turn out a top-notch product. However you are also not paying for all of those sometimes nebulous, frills.

The Percom board has two big advantages. It has the lowest pricetag of the all assembled and tested boards, and it predates the nicest looking alphanumeric display. On the other hand, it has the least amount of available options and only half the graphics mode resolution the other boards possess. Also, should anything go wrong, troubleshooting will be more difficult due to lack of a fully-socketed board. For those still on a budget, inclined more towards using than building, and primarily interested in alphanumeric applications, the Percom board should represent the best value received for the dollar spent.

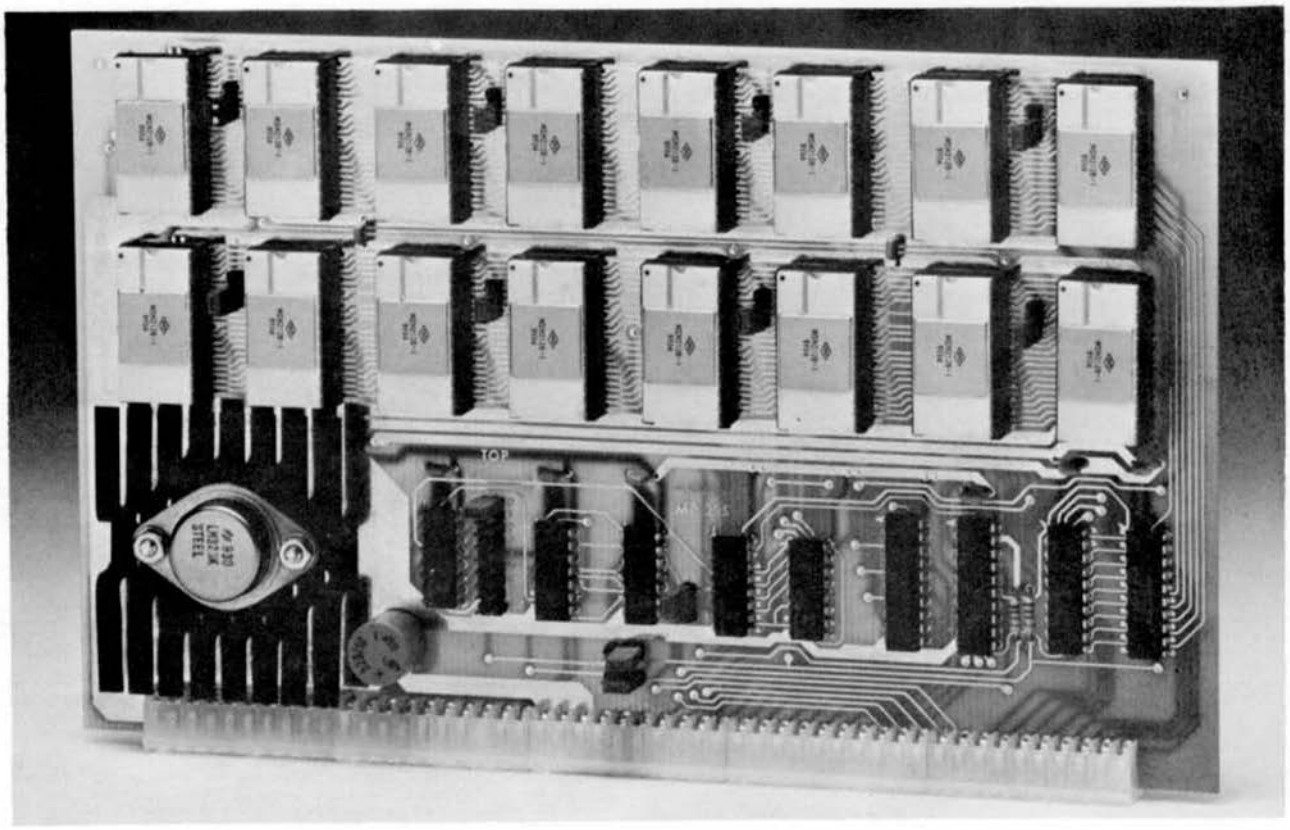
Gimix leaps us into another category altogether. This is definitely a commercial quality board with a slightly less than commercial pricetag. This board is definitely not for the budget minded. However, its wealth of features is perhaps sufficient to warp many into splurging in this area and shaving elsewhere. The programmable character generator alone is very tempting. Remember though, the Gimix board will probably require a higher quality CRT monitor to be most effective. The one feature I do not like is the self boot up of the format registers. I feel these registers should be left under the control of the user.

Quality-wise, the SSB board equals, perhaps even surpasses, the Gimix board. The circuit design is extremely sound, but rather straightforward. The only unique circuit feature is that the video drivers are included in firmware on the board. Although these drivers provide some powerful functions, the same functions can be programmed into any of the video boards. I feel this board could use some of the innovative features normally associated with higher quality, higher priced products.

The scale tipper for SSB would have to be manufacturer credibility. Of all the manufacturers I contacted, SSB proved to be the most helpful with the least amount of prodding. They were the only ones who volunteered to lend an evaluation board for this article -- and did not even complain when the board was returned four weeks late! I have no doubt that SSB would not only provide a reliable product but also plenty of prompt and courteous backup service.

WHAT'S NEXT?

As good as these video boards are, state of the art hardware in industry has already outstripped their capabilities. Some of this technology is even now trickling down into the newer home



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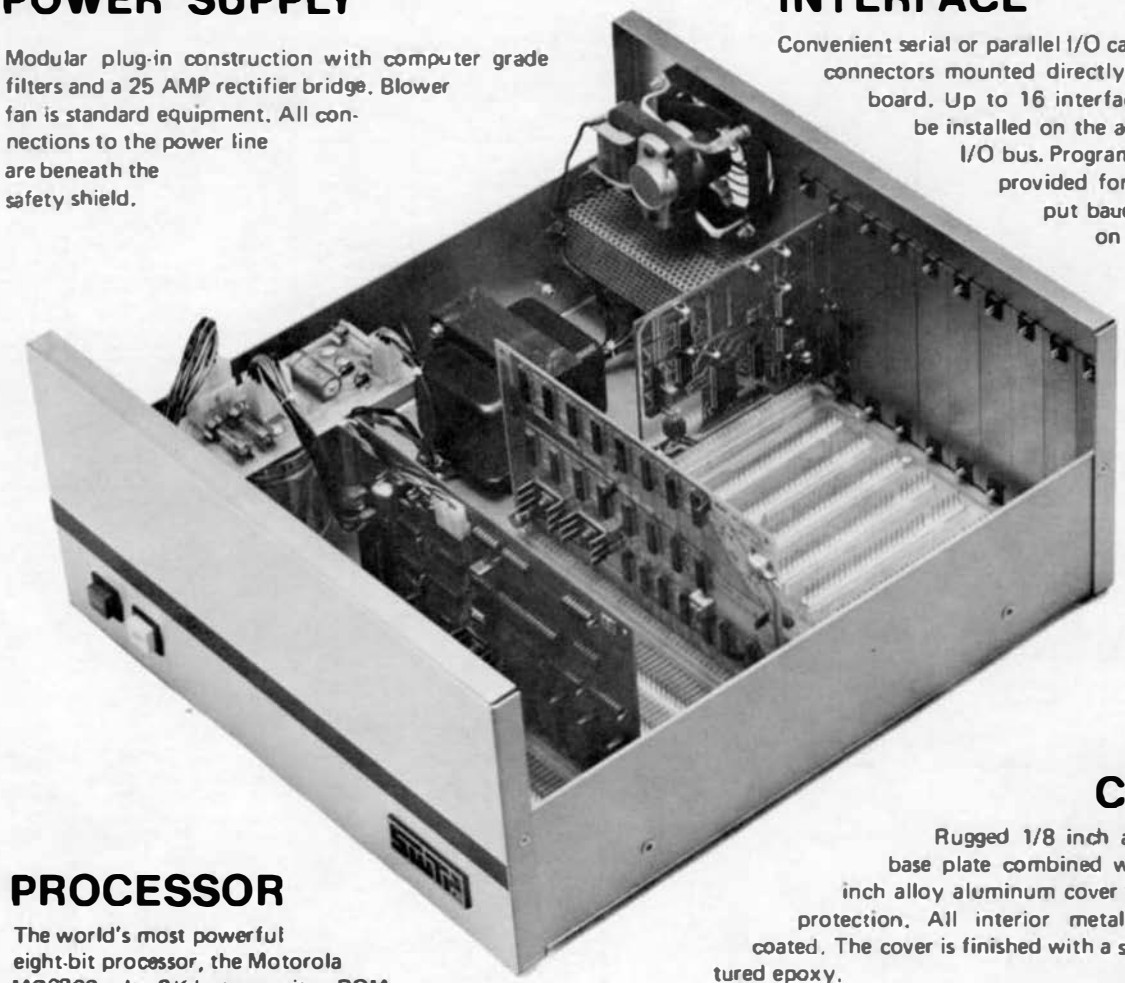

CABINET

Rugged 1/8 inch alloy aluminum base plate combined with a solid 1/8 inch alloy aluminum cover for unsurpassed protection. All interior metal is conversion coated. The cover is finished with a super tough textured epoxy.

PROCESSOR

The world's most powerful eight-bit processor, the Motorola MC6809, plus 2K byte monitor ROM that is 2716 EPROM compatible and full buffering on all output lines. Built-in multiuser capability, just add I/O cards to operate a multi-terminal system.

MEMORY— You can purchase the computer with either 8K bytes of RAM memory (expandable to 56K), or with the "S" series 64K bytes of RAM memory expandable to 768 K.

PERIPHERALS—The wide range of peripheral hardware that is supported by the 6809 includes: dot matrix printers (both 80 and 132 column), IBM Electronic 50 typewriter, daisy wheel printers, 5-inch floppy disk system, 8-inch floppy disk systems and a 16 megabyte hard disk.

SOFTWARE— The amount of software support available for the 6809 is incredible when you consider that it was first introduced in June, 1979. In addition to the FLEX9 operating system, we have a Text Editor, Mnemonic Assembler, Debug, Sort-Merge, BASIC, Extended BASIC, MultiUser BASIC, FORTRAN, PASCAL and PILOT.

69/K Computer Kit with 8K bytes of memory ..... $ 660.00
69/A Assembled Computer with 8K bytes of memory ..... $ 799.00
09/ Assembled Computer "S" series with 64K bytes of memory $1,835.00

SWTPC

SOUTHWEST TECHNICAL PRODUCTS CORPORATION
219 W. RHAPSODY
SAN ANTONIO, TEXAS 78216 (512) 344-0241

computers. What needs to be developed now is a video board with simultaneous alpha, semigraphics, and full graphics capability, plus character by character control of ALL attributes. The graphics should be high speed, have resolution of at least 256 x 192, be flicker free, and have optional gray scale or color capability. Annotated and animated graphics displays were a dream yesterday, are a reality today, and will be a necessity tomorrow.

Preparing for things to come, part two of this article will tackle graphics. Easy and inexpensive modifications will be given that will convert the F & D board into a 256 x 192 pixel graphics board. A set of machine language graphics drivers will also be presented that will allow you to begin immediately writing some graphics applications programs.

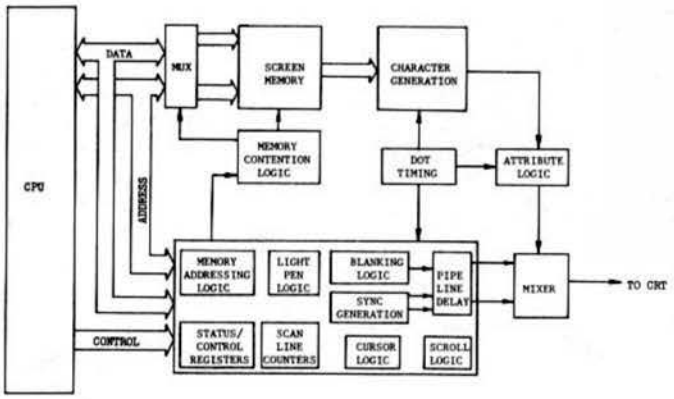

FIGURE 1. Memory-Mapped Video Board -- Block Diagram

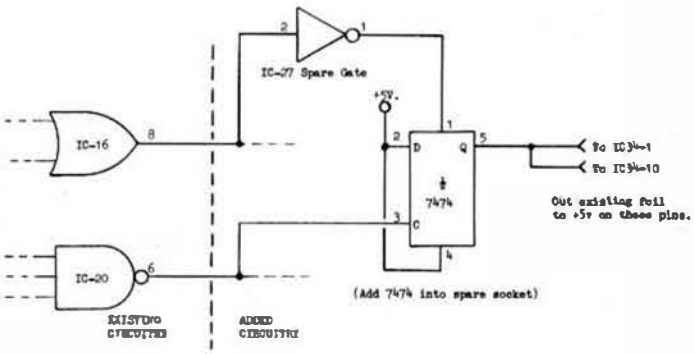

FIGURE 2. Modification to F & D Board to eliminate access flicker.

FEATURES	MOTOROLA 6845	SMC 5027
Pins Power Supplies Process	40 +5 NMOS	40 +5, +12 NMOS
Dot Timing Oscillator	External	External
Interlace Operation	Yes, 2 modes	Yes
Monitor Interface Horiz/vert sync Composite video	Yes No	Yes No
Display Format Range Characters/row Rows/frame Scan lines/row	1 - 256 1 - 128 1 - 32	20 - 132 1 - 64 1 - 16
Memory Address Range Memory Addressing Method	16k bytes Linear	4k bytes Row/Column
Internal Cursor Register and Mode Control	Blink, block, and underline	Block only
Light Pen Register	Yes	No
Address Scrolling	Yes	Yes
Other Visual Attributes	None	None
Memory Contention Logic	None	None
Video Pipeline Control	No	Yes
Programmable Registers Horiz format/timing Vert format/timing Operating Registers	4 6 Cursor Pos (2) Start Addr (2) Light Pen (2) Cursor Fill(2)	2 4 Cursor Pos(2) Scroll (1)

TABLE I. Summary of CRT Controller features.

FEATURE	F & D ASSOC.	PERCOM	GIMIX	SMOKE SIGNAL
CRT Controller Used	6845	5027	5027	6845
Retail Price	(See Text)	$260	$460	$395
Character Cell Size	8 x 12	10 x 14	8 x 10	8 x 10
Primary Char. Gen. Matrix	7 x 9	7 x 9	5 x 7	5 x 7
Other Char. Generators	Yes (2708/16)	Yes (2708/16)	Yes (2716)	no
Programmable Char. Gen.	No	No	Yes (128 Chars)	No
On Board Screen RAM	4k bytes	2k bytes	2k bytes	2k bytes
Screen RAM Addressing	Any 4k Block	2k-CA,D0-D7 E8	Any 2k Block	Any 4k Block
Other Addresses Req'd	25b Bytes at X5XX or X7XX	None	4 Bytes at any 4 Byte Boundary	None
Video Cable Socket	No	No	Yes	Yes
Gold-Plated Buss Connectors	------	No	Yes	Yes
Epoxy Solder Mask	No	No	Yes	Yes
Silk-Screened Labels	No	No	No	Yes
Dot Clock Frequency	14.318 MHz	16.000 MHz	15.091 MHz	17.055 MHz
I.C. Count	37	30	36	31
User I/O Port	½ PIA	None	None	None
Separate Sync & Video Out	Yes	Yes	Composite Only	Composite Only
Display Formats Available	Programmable	Programmable	80 x 24 Only	Programmable
Visible Access Flicker	Yes	No	No	No
Video Driver Software	Source Listing	Source Listing	Source Listing	On Board EPROM
Memory Contention Logic	CPU Priority	CPU Priority	CPU Priority & Vert. Retrace	CPU Priority
Attributes Available	Inverse Video, or Half Intensity, or Graphics ROM	Inverse Video, or Half Intensity, or Graphics ROM	Selected by control Port (See Text)	Inverse Video, or Half Intensity, or Graphics ROM

TABLE II. Video Board Comparison Chart

July 22, 1981

Mr. Don Williams
'68' Micro Journal
3018 Mamill Rd.
Hixson, TN. 37343

Dear Don:

Frank Hogg Laboratory, Inc., is pleased to announce that A.G.S. Jackson is our "exclusive" dealer in South Africa.

Orders generating from the South Africa area only can be sent to:

A. G. (Guy) S. Jackson
7 Beaufort Avenue
Craighall Park
Johannesburg 2196
Republic of South Africa

Telephone: 788-8288
788-2773

Thank you for the opportunity of helping us to welcome Guy on board.

Very truly yours,

Frank Hogg
President

FX:hh

FRANK HOGG LABORATORY, INC

te hni al systems consultants, inc.

Dear Don,

In response to the mail you have been receiving concerning Unifilk", let me try to answer a few questions.

Unifilk" does NOT require programs to be relocatable. Programs also do NOT have to be re-entrant. I think these misconceptions have come about do to the requirements of Microware's OS-9 level I which does require fully position independent code. I do not currently know what the requirements of OS-9 level II are.

Another question which is often asked concerns FLEX™ software compatibility with UniFLEX™. At the assembly language level, programs are definitely incompatible. It is certainly possible to convert FLEX™ software to run under UniFLEX™, and essentially involves rewriting the I/O sections of the program. We are currently playing with a version of FLEX™ which runs as a task under UniFLEX™ which would allow one to run any FLEX™ software with the exception of the FLEX™ printer spooler capabilities.

We are also working on a special version of FLEX™ which will run on a computer system configured to run UniFLEX™. Currently, the DOS and several machine [illegible] must be changed to switch a system between FLEX™ and UniFLEX™. This special version of FLEX™ will allow one to boot and run FLEX™ on the UniFLEX™ system without any changes. The only limitations in this version of FLEX™ are that printer spooling will not be supported and there will be no hard disk drivers.

Transporting other software between FLEX™ and UniFLEX™, such as BASIC or PASCAL source files is a simple matter. Many of these programs will run unmodified or will require only minor modifications to run. UniFLEX™ is provided with a utility which will copy FLEX™ files from a FLEX™ disk onto a UniFLEX™ disk. We will very shortly make available a utility which copies files the other way, i.e. UniFLEX™ to FLEX™.

We have been receiving many questions concerning upcoming UniFLEX™ support software. Some of the soon to be released programs include: Relocating Assembler and Linking Loader, Extended Utility Package, ANSII Standard FORTRAN 77, and a full specification C Compiler. Software in the works for release over the next twelve months include: Screen Oriented Word Processing Package, COBOL Compiler, ADA Compiler, various language Debug Packages, as well as several surprises. UniFLEX™ has been extremely popular and we will be supporting it quite heavily in the upcoming months. Many of the above mentioned programs will also be available for 6809 FLEX™.

P.O. Box 2570 • 1208 Kent Avenue • West Lafayette, Indiana 47906 • (317) 463-2502

MICROWARE.

Microware Systems Corporation
[illegible] Grand Avenue, Box [illegible], Des Moines, Iowa 50304
515-[illegible]

July 24, 1981

Don Williams
68 Micro Journal
3018 Hamill Road
Hixson, TN 37343

Dear Don,

Thanks for sending me a copy of Dave Nyberg's letter. I found his comments most interesting and typical of many questions that have been asked of us regarding compatibility of "old" 6800 and 6809 software on OS-9.

It is true that it is mandatory for assembly language programs written for both OS-9 Level One and OS-9 Level Two to be position-independent code (PIC). There are several good reasons for this.

First, it allows OS-9 to use software memory management on smaller (less than 64k) machines that don't have hardware memory management.

Second, it permits two or more programs or software modules to be loaded into memory at the same time without overlaying each other. For example, both an editor and assembler program can be co-resident without the need to reassemble one or the other. This lets you load and use several programs in memory without time consuming disk operations.

Third, it makes it possible for two or more users to "share" the same physical copy of a program or programs without the need to load additional copies. This can reduce the overall system memory requirements considerably. This is why a 56K OS-9 system can run several Basic users without "swapping".

PIC is not required for shuffling memory around on a moment-by-moment basis as Dave surmised. It is physically impossible to do so because the 6809 keeps absolute addresses on its stack. It is required so OS-9 can initially load programs into any memory space not already in use by something else.

The requirement to use PIC on OS-9 is not costly in terms of program size or speed, thanks to the 6809's PC-relative addressing modes. Old programs have to be edited to change JMP instructions to LBRAs, etc. These programs have to be edited anyway because the interfaces to the operating system are considerably different in OS-9 and Uniflex than in Flex, for example.

PIC is mandatory on OS-9 Level One systems because all tasks reside in the same address space. However, in OS-9 Level Two each task has its own address space so non-PIC code can be executed under controlled circumstances. Therefore it is possible that a "Flex-adaptor" subsystem, as Dave suggested, could be written for OS-9 Level Two, but not for Level one. The "Flex-adaptor" could probably handle many Flex programs as-is, with the notable exception of those programs that interface directly to I/O devices or the physical disk structure. I should mention that Microware has no plans to offer this kind of adaptor for Flex, DOS, or any other OS at this time.

Is conversion an unfair burden to impose on those persons who have a large library of software written for 6800/6809 Flex, DOS-68, etc.? I don't think so. The program modifications required are usually not that imposing, and we offer OS-9 software tools which make conversion jobs easier. For example, using our Macro Text Editor (which is really an interactive string processing language) you can create a library of editing procedures that will do much of the conversion automatically. And the OS-9 Assembler has special capabilities for production of PIC programs (it even prints warning messages on non-PIC instruction lines).

What do you get in exchange for your efforts? OS-9 is friendlier, easier to use, faster, more reliable, better documented, and has much, much more capability than other 6800 or 6809 operating systems.

This is not the first time, nor will it be the last time, that the conversion problem will confront us because we all use the products of a rapidly developing and changing technology. My advice is to anticipate and prepare for change. What will everybody do when the 68000 chip (and its successors) cost $10 each? The conversion from the 6809 to the 68000 is more complex than the conversion from the 6800 to the 6809 because the 6809 uses a superset of 6800 instructions, but the 68000 has a much different instruction set than the 6809.

Probably the wisest course is to write both application and system software in high-level languages (especially using Pascal and C compilers) which are more portable from CPU to CPU. This has not been possible before but the new breed of languages (such as the OS-9 Pascal compiler) let you do those things that previously were only possible or reasonable to do in assembly language. This will protect your software investment in the future. Software written for OS-9 in PASCAL, BASIC09, C, COBOL, etc., will execute on the forthcoming 68000 versions without conversion.

There is no better time than today to "bite the bullet" and switch over. The world in general (including the 68XX community) is rapidly climbing aboard the UNIX bandwagon for many good reasons. Almost every new micro and mini operating system being written today is based on UNIX, so by converting to OS-9 now you'll be compatible for a long, long time.

That's my two cents worth, Don. I hope that my comments will be of value to Dave and everyone else who has hesitated to enjoy the pleasures of the 6809 because of fear of conversion hassles.

Warmest Regards,

Ken Kaplan
Microware

technical systems consultants, inc.

P.O. Box 2570 • 1208 Kent Avenue • West Lafayette, Indiana 47906 • (317) 463-2502

PRODUCT ANNOUNCEMENT
UniFLEX™ Basic Version 2

Version 2 of UniFLEX Basic contains several features not found in Version 1. Most of these are enhancements suggested by our customers. We are grateful in t honor their suggestions. This document summarizes the new features of Ba ic 2 and also lists some of its drawbacks.

Added Features
The most significant addition to Basic is the statement editor command. This command allows the user to change an existing statement in the Basic program without having to retype the entire statement. In order to make the editor even more useful, Basic has been modified so that if it detects an error when a statement is being typed or loaded from a disk file (unbalanced parentheses, for example), the erroneous statement is changed into a remark. The user may then use the editor to correct the statement and not have to retype the line or reload the file. If this occurs when loading from a disk file, the loading process will not stop when such errors are detected, but it will proceed until the entire file is loaded, reporting errors as it goes. All of the offending lines will have been converted to remarks so that the user may then correct them with the editor.

The "fre(0)" function was not very useful in Basic 1. In Basic 2, this function has been replaced by the "mem(0)" function. This function returns the number of bytes currently being consumed by Basic. Included in this number is the size of Basic itself, its run-time variables and stack, as well as any space used by the user's program and data.

A new string constant "term$" is available which is always equal to the terminal number associated with Basic. This number is a string with no leading or trailing spaces.

A "chd" statement is available which allows the program to change directories while running.

Under Basic 1, the only way that one Basic program could pass information to a program to which it chained was through a disk file. In Basic 2, it is possible for programs to declare an area as being "common". Strings may be declared in this common area with a form of the "field" statement, and values stored in these strings with the "lset" and "rset" statements. Integer and floating point values are stored in these strings by using "lset" or "rset" in conjunction with the "convert" functions.

Drawbacks
The additional features of Basic 2 do not come without a price. Basic 2 is somewhat larger than Basic 1, so that if a user had a program which

barely fit in memory with Basic 1, it may not fit with Basic 2. The most serious drawback is that the "compiled" form of Basic programs is significantly different between Basic 1 and Basic 2. Basic 2 cannot run programs that have been "compiled" under Basic 1. Similarly, Basic 1 cannot run programs "compiled" by Basic 2. This also holds true for the UniFLEX Basic Precompiler. Basic 2 will only run programs that have been compiled under version 2 of the Precompiler. We are sorry to say that the changes in the "compiled" format are so major that it is not possible to write a conversion program to convert from Basic 1 to Basic 2. All programs will have to be recompiled under Basic 2 or Basic Precompiler 2. We realize that this is an inconvenience, especially to those who sell applications programs in "compiled" form. However, we feel that the enhancements are worth it.

Basic 2 will become the "standard" UniFLEX Basic and will be the only version that we sell. It is now available as an update under our usual UniFLEX update procedures. As long as it is does not become an excessive burden, we will attempt to maintain Basic 1 along with Basic 2, so if you do not want to convert to Basic 2 you may request updates for Basic 1. However, maintenance on Basic 1 will not be renewed when your current maintenance agreement expires.

Please remember that you must also upgrade your Basic Precompiler (if you have one) when you upgrade your Basic.

NEWSRELEASE

FOR IMMEDIATE RELEASE — August 18, 1981

MICROCOMPUTER LINE NOW AVAILABLE UNDER GSA CONTRACT

WESTLAKE VILLAGE, CA...SMOKE SIGNAL, manufacturers of the CHIEFTAIN (tm) Series of business computer systems, and PATHFINDER(tm) Development Systems, have just announced that these product lines are now available under GSA (General Services Administration) contracts.

The CHIEFTAIN and PATHFINDER computer systems are based on Motorola's 6800 and 6809 processors and are configured to the S-50 bus. Business application software, development system software and tools, communications packages and high-level languages (such as COBOL, PASCAL, FORTRAN, BASIC) are all available from Smoke Signal for both lines of computer systems.

Smoke Signal computers range in capacity from single-user dual 5¼" floppy-based systems to dual 8" systems up to 8" Winchester hard disk systems with spare streamer options and multi-user capability. All Smoke Signal computer systems run OS-9 LEVEL I and II (tm), the UNIX-like multi-user, multi-tasking operating system developed by Microware Systems Corporation.

Smoke Signal will be exhibiting the CHIEFTAIN and PATHFINDER Series of computer systems at the Federal Computer Conference, Sept. 21-23, in Washington D.C., booth #125. Information on the new Smoke Signal GSA schedule and contract will be provided at the conference.

For further information, please contact: Jim Allday
National Sales Manager
-and-
Deborah Conrad, Manager
Dealer Sales and Support

SMOKE SIGNAL BROADCASTING 31336 Via Colinas, Westlake Village, CA 91361 • Tel (213) 889-9340

DAVIDSON SOFTWARE SYSTEMS
PO BOX 21002 • LANSING MICHIGAN 48909 • PHONE 517 332 5989

NEWS RELEASE
For Immediate Release

July 23, 1981

Editor
68 MICRO JOURNAL
3018 Hamill Road
P.O. Box 849
Mixon, Tennessee 37343

ENHANCED COMPUTERIZED DICTIONARY

Lansing, Michigan--Davidson Software Systems has just announced release 2 of the "Computerized Dictionary" software system. The programs run under the FLEX operating system. The product aids word processing users by editing text for spelling errors, a company spokesman said.

As in release 1, misspelled words are highlighted and can be changed automatically by the system. The system is said to operate in two modes for examining text information. In interactive mode, any words not found in the dictionary file are displayed. The operator then has an opportunity to ignore the word, key in a new word to replace it, or if the word is actually correct, add it to the dictionary file. Frequently misspelled words can be automatically changed by the system. For example, whenever the system encounters "thier" it is changed to "their". As users correct their misspelled words, they can optionally instruct the system to thereafter automatically make the change.

In list mode, the spokesman explained, the text will be printed or displayed as it is being processed. Any misspelled words are highlighted on the listing. No operator intervention is required when in list mode.

Release 2 is said to operate 30% to 50% faster. A full page of text, about 425 words, can be edited in 3 1/2 minutes (depending on the system configuration). An average size letter can be edited in 2 minutes or less.

A dictionary file is included with the system, although the user can add words at any time with one key stroke. The dictionary files can also be listed or displayed. All the systems functions are accessed from a menu for operator convenience.

The system comes complete, with an installation guide and operations manual, ready to use. Current Licensees may receive release 2 for a $25.00 shipping charge. The package has a one time charge of $100.00. For more information, contact Davidson Software Systems at Box 21002, Lansing, Michigan, 48909 or call 517-332-5989.

Released by

Richard E. Davidson, Jr.

July 12, 1981
946 Evans Rd.
Nashville, TN 37204

Mr. Dan Williams, Sr.
'68' Micro Journal
3018 Hamill Rd.
P. O. Box 849
Mixon, TN 37343

Dear Sir:

Here is an item for the "Bit Bucket" that will be interesting to any fossils still using SWTPC 6800 Co-Res Editor-Assembler version 1.01. The character string search routine uses the stack pointer as an index register, but doesn't properly save it - a sure invitation to disaster. The bug is at $1AD6, and the fix is as follows:

Old Code		New Code	
Address	Data	Address	Data
1AD6	8E	1AD6	7E
1AD7	1B	1AD7	02
1AD8	33	1AD8	95
		0295	9F
		0296	3B
		0297	8E
		0298	1B
		0299	33
		029A	7E
		029B	1A
		029C	D9

The code at $0295 - $029F is unreachable and I presume it's left over from some previous version of Co-Res. Anyway, it is a handy spot for patch code.

The bug doesn't cause Co-Res to bomb every time the search function is used. The stack pointer is saved at $3B - $3C in several other routines, and when the search routine restores the stack pointer with an LDS $3B, it usually has the right value. But sometimes it doesn't and that's when Co-Res goes off into never-never land, taking your program with it.

Very truly yours,

William R. Hamblen

WINDRUSH
Micro designs Ltd.

Gaywood Way Industrial Estate
North Walsham
Norfolk NR28 0AN
Tel (06324) 6489
Telex 975212

'68' MICRO JOURNAL
New Products Editor
P.O. box 849
Mixon
Tennessee 37343 U.S.A.

Your Ref | Our Ref WCD/MK 324 | Date 29/6/81

PRESS RELEASE INFORMATION

Windrush Micro Designs Ltd., Gaywood Way Industrial Estate, North Walsham, Norfolk announce the introduction of their REAL WORLD INTERFACE for use in S-50 based 6800 and 6809 MICROCOMPUTER SYSTEMS. The board, as it's name implies, is intended to interface a microcomputer with industrial control systems.

FEATURES

- EIGHT CHANNELS OF RELAY OR OPTICALLY ISOLATED INPUT.
- EIGHT CHANNELS OF RELAY OR OPTICALLY ISOLATED OUTPUT.

- 8 X 8 KEYBOARD MATRIX ENCODER THAT IS SOFTWARE DRIVEN. THIS ENABLES THE USER TO DEFINE THE CODE PRODUCED BY ANY OF THE 64 KEYS IN SOFTWARE, A VERY VALUABLE FEATURE WHEN NON ASCII CODES ARE REQUIRED.
- THREE CHANNEL PROGRAMMABLE TIMER. PROVIDES CLOCK RATES AND TIMED INTERVALS UNDER CPU CONTROL.

Luciddata

Luciddata Ltd PO Box 128
Cambridge CB2 5EZ England
Telephone (0223) 841906

To
Don Williams
'68' Micro Journal
Computer Publishing Inc.
3018 Hamill Road
Hixson
TN 37343
U.S.A.

Our Ref
Your Ref

Date Thursday May 7th 1981

Dear Don,

I was interested to read Dave Shirk's column on speed in your April issue and heartily agree with his observations on the meaning of "better" as it is currently being applied to software implementations.

Many characteristics of computer software are inherently qualitative in nature and this is one of the reasons why people can "prefer" one product over another. I for one, could never get on with some mini-computer, character-oriented text editors, finding that the line oriented editors were much more in tune with the way my mind worked. It is, however, quite in order to use such terms as "user-friendly", "forgiving", "easy-to-use" etc. when referring to such qualitative characteristics AND when it is cle r that a subjective assessment is being made.

There are many other characteristics of computer softw re which are quantitative in nature, and consequently, are amenable to the Age old measurement technique loosely called "The Scientific Method". As a scientist, I am a great believer in "measurement" as an objective means of comparing the properties of things that are capable of experimental investigation and verification. That last word, verification, is very important as it is a fundamental component of the scientific method. It means that if you re going to publish numbers which are meant to be the results of scientifically performed experiments, sufficient detail should be provided about the experimental setup (such as processor speed and software version in this case) to enable independent verification.

I used the Wirth algorithm as published in the article and compiled it using different Pascal language translators on the following system:
1 MHz 6809, 56K bytes (450nS), 38.4K baud terminal,
16 M byte Marksman disk and FLEX 9 operating system
As my experimental objective was only to compare the execution times of the algorithm in different translations, I chose not to print the results. Thus the only relevent hardware parameters, in this case, were processor type and clock frequency. Execution of this algorithm is independent of the DOS. The time interval between the fir t two primes (which were printed), and the final FLEX +++, were as follows:

(i)	Luciddata Pascal 6809 Release 2 (2.9)	183 secs
(ii)	Luciddata Pascal 6809 Release 3 (3.9)	119 secs
(iii)	TSC Pascal 6809 Version 1.0	14 secs
The P-code binaries of (ii) were also executed on a 1MHz 6800		
(iv)	Luciddata Pascal 6800 Release 3 (3.2)	188 secs

"....And things are not what they seem" (Longfellow)

Regards Nigel

Directors E J Bennie N W Bennie Reg Office Equity House 42 Central Square Wembley Middlesex HA9 7AT
Reg No 1383816 (England)

microdyne

July 20, 1981

Mr. Don Williams, Publisher
'68' Micro Journal
3018 Hamill Road
P.O. Box 849
Hixson, Tennessee 37343

Dear Don,

For the last few months we have advertised a BR-1 Bit Rate Generator with an upgrade kit for those who have a Southwest Technical MPA board. Although we feel that the advertisement is clear, we continue to receive orders for the upgrade kit alone. However, the purpose of the kit is to allow users who purchase a BR-1 to use the chips off of an MPA board and still have a functional 6800 processor.

Of course, if someone already has another source of baud signals, then the crystal upgrade kit will give them a much more stable CPU board and increase their processor speed by approximately 12%. Also, there is a way to use the components in the kit to increase processor speed and not effect the on-board bit rate generator. However, this involves implementing the upgrade circuit by "piggy backing" the IC and making several mo ifications to the CPU board. We do not provide instructions for this particular approach and do not recommend the kit be purchased unless the buyer is fully aware of the limitations of this kit as a stand alone item.

We apologize to those who have experienced inconvenience or disappointment when their money was returned with no kit. We hope that this will clarify this problem.

Sincerely,

G.H. Holloman, Jr.

GHH/lh

Southeastern Micro Systems, Inc.

P. O. BOX 293 1910 IRIS DRIVE CONYERS, GEORGIA 30207
(404) 922-1030

August 14, 1981

Dear Readers:

It has recently come to our attention that our company has been confused with another company named "Southwest Micro Systems". As you may remember there was a notice printed in the July issue of the Micro Journal concerning Southwest Micro Systems and their inefficient business practices. Since the appearance of that article it seems that we have been assumed to be the company in question. We ask you readers to please take note that we are Southeastern Micro Systems, Inc. in Conyers, Georgia, and we are in no way affiliated with Southwest Micro Systems in Texas.

We are very proud of our growing number of satisfied customers. We have received several letters from our customers telling us how pleased they are with our products and our service. In fact, one of our customers published his letter in the April 1981 issue of the Micro Journal.

We hope that this letter will resolve any wrong ideas t at the readers of the Micro Journal may have.

Sincerely,

SOUTHEASTERN MICRO SYSTEMS, INC.

Wayne Ashe
President

SYSTEM LOGO-PASSWORD PROGRAM

by Lee H. Hoffman
583 Cardinal Lane
Post Office Box 8
Mt. Sterling, KY
40353
(606) [illegible]

This program is a quickie program that I cooked up one night for the fun of it. It is designed to be called from FLEX-9 by the system startup procedure. I have my Startup file call it last after all TTYSET, ASN, etc. initialization is completed.

It will display the logo '6809 SYSTEM' (see figure 1) on the CRT and will ask for the password to be entered. If the correct password is entered, the buffer area that would contain the password is cleared for extra protection of the password, and control is returned to FLEX-9. returned to FLEX. However, if the password is incorrect, the CRT is cleared, the message "INVALID PASSWORD" is displayed, all of the system RAM memory is cleared (from $0000 to the end of FLEX-9), and control is returned to the system monitor. This will prevent anyone from trying to gain access to your system without your authorization. In addition, it allows you some of the advantages of the larger systems including the ability to 'advertise' the 6809 chip to any of your friends who aren't lucky enough to have a 6809 system.

The program is presently designed to accept the word 'OPEN' as the password. My program library actually contains the source file without any password in it. Also the object program is catalog-protected as well as my Startup file. This prevents anyone without much knowledge of FLEX-9 from obtaining the password. Also I do not have any disk utility program handy that can be used to display the contents of the disk by sector or by file.

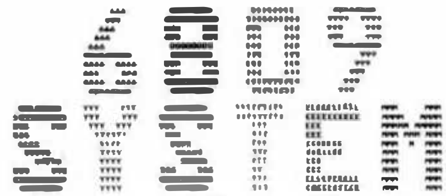

Figure -1-

```
DISPLAY                         7-24-81 TSC ASSEMBLER   PAGE   1

          *****************************************
          *                                       *
          *    THIS PROGRAM WILL CLEAR THE        *
          *    CRT SCREEN AND WILL DISPLAY        *
          *    A [illegible]                      *
          *                                       *
          *    CONTROL WILL THEN PASS TO A        *
          *    ROUTINE THAT WILL REQUEST A        *
          *    PASSWORD BE ENTERED BY THE         *
          *    OPERATOR.  IF THE PASSWORD         *
          *    IS [illegible], THE PROGRAM WILL   *
          *    [illegible] AND CONTROL WILL       *
          *    RETURN TO THE [illegible] MONITOR. *
          *                                       *
          *                                       *
          *       BY LEE H HOFFMAN                *
          *                                       *
          *       DECEMBER [illegible], 1980      *
          *                                       *
          *****************************************

          *****************************************
          *                                       *
          *   [illegible] PROGRAM [illegible] THE *
          *   BASIC PROGRAM IS MODIFIED TO        *
          *   CONTAIN THE ACTUAL PASSWORD         *
          *   AND ITS LENGTH IN THE COUNT         *
          *   FIELD.                              *
          *                                       *
          *   INSERT THE PASSWORD INPLACE         *
          *   OF NULLS IN THE WRDBFR - THE        *
          *   PASSWORD MAY BE UP TO EIGHT         *
          *   CHARACTERS LONG AND MUST BE         *
          *   PLACED SO THAT THE FIRST            *
          *   CHARACTER IS IN THE FIRST OF        *
          *   THE EIGHT POSITIONS IN THE          *
          *   WRDBFR LOCATION WITH NULLS          *
          *   FILLING THE REMAINDER OF THE        *
          *   BUFFER FOLLOWED BY A BYTE OF        *
          *   ZERO ($00) AS A END OF TEXT         *
          *   SIGNAL.                             *
          *                                       *
          *   INSERT THE LENGTH OF THE            *
          *   ACTUAL PASSWORD (NUMBER OF          *
          *   CHARACTERS) IN COUNT.  THE          *
          *   COUNT MAY BE ANY HEX NUMBER         *
          *   FROM ONE TO EIGHT.                  *
          *                                       *
          *****************************************
```

```
DISPLAY                          7-24-81 TSC ASSEMBLER

                          * EXTERNAL LABEL EQUATES

          [illegible]
          CD1E   PSTRNG  EQU  [illegible]
          [illegible]
          CD03   [illegible]  EQU  [illegible]

                  *    [illegible]

          000D   CR      EQU  $0D
          000A   LF      EQU  $0A
          000C   FF      EQU  $0C
          0020   SPC     EQU  $20
          0004   EOT     EQU  $04
          0000   NUL     EQU  $00
          [illegible] ES EQU  [illegible]
          [illegible] RS EQU  [illegible]

0000                     ORG  $0000

[illegible]              LDX  #MESAGE   POINT TO THE MESSAGE
[illegible]              JSR  PSTRNG    PRINT IT

[illegible]              LDX  #PSWDMS   ASK FOR PASSWORD
[illegible]  CD1E        JSR  PSTRNG
[illegible]  0073        LDX  #INBUFR   POINT TO INPUT BUFFER
[illegible]              LDAB COUNT     [illegible]

[illegible]  F004  INWRD JSR  [INCHNE]  [illegible]
[illegible]              STAA 0,X+      [illegible]
[illegible]              DECB           [illegible]
[illegible]              BNE  INWRD     [illegible]

[illegible]        CHKWRD [illegible]   [illegible]
[illegible]
[illegible]                             PUT COMPARE CHAR ON STACK
[illegible]                             DRAW OFF STACK AND SEE IF SAME
[illegible]              BNE  [illegible] NOT SAME - GO SECURE IT ALL
[illegible]              DEC  COUNT     [illegible]
[illegible]              BNE  CHKWRD    [illegible]

[illegible]        DONE  [illegible]
[illegible]              [illegible] ZEROSM [illegible]
[illegible]  CD03        JMP  WARMST    GO TO [illegible]

[illegible]              [illegible]    TELL THAT [illegible]
[illegible]              JSR  PSTRNG
[illegible]              LDAA #NUL

DISPLAY                          7-24-81 TSC ASSEMBLER

SYMBOL TABLE
[illegible]

DISPLAY                          7-24-81 TSC [illegible]
[illegible]              [illegible]    ... WIPE IT CLEAR TIL
[illegible]              [illegible]    ...END OF MEMORY?
[illegible]              BNE  [illegible] IF NOT DONE-KEEP GOING
[illegible]              LDX  #ENDFLX   POINT TO END OF FLEX-9
[illegible]              [illegible]    FOR WIPING IT OUT
[illegible]              [illegible]    NOW WIPE OUT BUFFERS
[illegible]              JMP  [illegible] GO OUT

[illegible]              [illegible]    POINT TO 1ST ADDRESS
[illegible]
[illegible]              [illegible]    END OF BUFFERS?
[illegible]

[illegible]        COUNT FCB  [illegible] INSERT ACTUAL LENGTH OF PASSWORD

[illegible]              FCC            [illegible]

[illegible]        INBUFR FCB [illegible]
[illegible]

[illegible]        MESAGE FCB FF
[illegible]              FCC / FCB [illegible]
[illegible]
                         END  DISPLA
```


A. WELLER
3217 PAGOSA COURT
EL PASO, TEXAS 79904

'68' MICRO JOURNAL
3018 HAMILL RD.
P.O. BOX 849
HIXSON, TENNESSEE 37343

Dear Don,

Of all the things that show up in my mailbox, I look forward to '68' the most. Every issue has at least one program I can use, usually more and the tutorials are just what I need. As far as I can tell, I'm the only 6800/09 owner in El Paso and I'd be in a vacuum without you. So please take my complaint in that context -- it's meant to be constructive.

It's the print size. I can't read some of the listings. Not bad eyesight (I'm 20/20), they're just too small. Don, I realize the spot you're in. Trying to cram as much good stuff in to a limited number of pages as you can. And in the face of rising costs, too. But when they become too small to read, their value is lost to us readers.

The problem seems to be at its worst when the source was many characters wide and you have to shrink it a lot to get it in one column width. Would you consider turning them sideways (like Interface Age does)?

I for one would be willing to settle for a little bit less in order to get it all legible. Perhaps a survey of the readers would show that most others agree.

In any case, keep 'em coming, 'cause I need 'em.

Best regards,

Art Weller

Art Weller

August 5, 1981

Flat 6, 47 Pakington St.,
Kew, Victoria, 3101,
AUSTRALIA

August 8, 1981

Mr. Don Williams
'68 Micro Journal
3018 Hamill Road,
P.O. Box 849,
Hixson,
TN 37343,
U.S.A.

Dear Don,

Before I get to the main business of this letter I just want to congratulate you and your team on your excellent magazine - keep up the good work.

Listed below are changes to the TSC 6809 TEXT PROCESSOR to enable full use of the features the new printers such as the Epson MX-80. These modifications are for version 6 of the processor but should be similar on other versions. The changes delete the command '.DB' and replace it with the command '.CC' which permits transmission of ASCII codes to the printer. Changes are listed for the lookup table (optional if .DB is not confusing to you) and the command subroutine area. The listing of areas adjacent to the changes may assist you in finding the locations in versions other than V6.

To use the command simply type '.CC N' where N is the decimal equivalent of the ASCII code to be sent.
e.g. .CC 27 sends the ASCII ESCAPE code. (Hex $1B)
.CC 27
.CC 69 sends ESCAPE followed by 'E' (MX-80 code for emphasised characters)

Now you can
expand,
contract,
emphasise
and more !
But unfortunately no changes within a line.

Yours Faithfully,

A. R. Bell

Alan R. Bell.

ORIGINAL				& NEW OVERLAY
0971	4457		FCC 'DW'	
0973	0C05		FDB CMD.DW	
0975	4442		FCC 'DB'	# 4343 FCC 'CC'
0977	0C0E		FDB CMD.DB	
0C05	17F31I	CMD.DW	LBSR $0719	
0C08	860E		LDA #$0E	
0C0A	9703		STA $0003	
0C0C	20F4		BRA $0C02	
0C0E	17F000	CMD.DB	LBSR $0911	# 170597 CMD.CC LBSR $11A8 GET NUMBER ROUTINE
0C11	860E		LDA #$0E	# 9665 LDA $0065 PULL NUMBER FROM STORE
0C13	9703		STA $0003	# 16[illegible] LBRA $0203 OUTPUT CHARACTER
0C15	1700C1		LBSR $1409	
0C18	20E4		BRA $0BFE	
0C1A	17FCFA	CMD.CE	LBSR $0917	
0C1D	170580		LBSR $1100	

A FAST METHOD OF DATA TRANSFER

Bud Pass
Computer Systems Consultants
1454 Latta Lane
Conyers, GA 30287

This article provides two short FLEX utility programs which are capable of reading data from a PIA port, implementing a local CENTRONIX interface. One program is intended to be used to send data to a printer, and the other is intended to be used to send text to a disk file. The only difference between the programs is that the second program filters most control characters from the data being placed on the disk.

This approach to data transfer has several major advantages. The primary advantage is its speed advantage over serial interfaces. Using this method, data may be transferred at 28,800 characters per second or better. Another advantage is flexibility; even non-FLEX (or non-6809) systems which implement a parallel CENTRONIX interface protocol (as most do) may be used as data sources. Still another advantage lies in its simplicity of expansion; the routines may be combined with other utilities, such as P,S,Q,D,SP, etc. to perform a variety of functions. In addition, because of the inherent bidirectional handshaking arrangement of the CENTRONIX interface protocol, there is no problem in stopping the input data stream to allow time for disk I/O or a slow printer or other device.

The CENTRONIX interface protocol is defined as follows:
eight output data lines, active high;
one output data strobe line, active low;
one input data acknowledgment line, active high.
This is normally implemented on a PIA (for output) as follows:
eight output data lines (D0-D7);
output data strobe line (C2);
input data acknowledgment line (C1).
and is normally implemented on a PIA (for input) as follows:
eight input data lines (D0-D7);
input data strobe line (C1);
output data acknowledgement line (C2).
Other parallel protocols generally differ from the CENTRONIX protocol only in the sense of one or more of the lines, not in structural interpretation. Only minor changes to the routines should be necessary to interface non-CENTRONIX interface protocols.

Listings of the FLEX routines appear below. Most FLEX systems using a parallel printer will have the "A" side of the PIA used to drive the printer available. If necessary, the addresses of the PIA and ACIA may easily be changed. In order to give the user some control over the routines, the input ACIA is scanned whenever the PIA is scanned; if a key on the keyboard is struck, the routines terminate.

```
                        * CENTRONICS RECEIVER FOR PRINTER XFER
                                OPT     PAG
                CD03    WARMS   EQU     $CD03       FLEX WARM START
                CD18    OUTPT   EQU     $CD18       FLEX PUT CHARACTER
                E01C    PIACA   EQU     $E01C       PIA ADDRESS
                0002    PIAAB   EQU     $02         SIDE A=$00,B=$02
                E004    ACIAC   EQU     $E004       ACIA ADDRESS
C100                            ORG     $C100
C100 7F E01F    START   CLR     PIACA+PIAAB+1 ADDRESS DDR
C103 7F E01E            CLR     PIACA+PIAAB DDR INPUTS
C106 86 34              LDA     #$34        C2 OUT MANUAL LOW
C108 B7 E01F            STA     PIACA+PIAAB+1 PROGRAM IT
C10B B6 E01F    NEXT    LDA     PIACA+PIAAB+1 CHECK FOR EDGE
C10E 2B 09              BMI     DATA        YES, READ IT
C110 B6 E004            LDA     ACIAC       CHECK ACIA
C113 44                 LSRA
C114 24 F5              BCC     NEXT        NO, LOOP
C116 7E CD03            JMP     WARMS       EXIT TO FLEX
C119 B6 E01E    DATA    LDA     PIACA+PIAAB GET DATA
C11C B7 E01E            STA     PIACA+PIAAB RESET
C11F C6 3C              LDB     #$3C        C2 OUT MANUAL HIGH
C121 F7 E01F            STB     PIACA+PIAAB+1
C124 C6 34              LDB     #$34        C2 OUT MANUAL LOW
C126 F7 E01F            STB     PIACA+PIAAB+1
C129 BD CD18            JSR     OUTPT       OUT UT TO FLEX
C12C 20 DD              BRA     NEXT        GO BACK FOR M RE
                        END     START
```

0 ERROR(S) DETECTED

```
                        * CENTRONICS RECEIVER FOR FILE XFER
                                OPT     PAG
                CD03    WARMS   EQU     $CD03       FLEX WARM START
                CD18    OUTPT   EQU     $CD18       FLEX PUT CHARACTER
                E01C    PIACA   EQU     $E01C       PIA ADDRESS
                0002    PIAAB   EQU     $02         OFFSET A=$00,B=$02
                E004    ACIAC   EQU     $E004       ACIA ADDRESS
C100                            ORG     $C100
C100 7F E01F    START   CLR     PIACA+PIAAB+1 ADDRESS DDR
C103 7F E01E            CLR     PIACA+PIAAB DDR INPUTS
C106 86 34              LDA     #$34        C2 OUT MANUAL LOW
C108 B7 E01F            STA     PIACA+PIAAB+1 PROGRAM IT
C10B B6 E01F    NEXT    LDA     PIACA+PIAAB+1 CHECK FOR EDGE
C10E 2B 09              BMI     DATA        YES, READ IT
C110 B6 E004            LDA     ACIAC       CHECK ACIA
C113 44                 LSRA
C114 24 F5              BCC     NEXT        NO, LOOP
C116 7E CD03            JMP     WARMS       EXIT TO FLEX
C119 B6 E01E    DATA    LDA     PIACA+PIAAB GET DATA
C11C B7 E01E            STA     PIACA+PIAAB RESET
C11F C6 3C              LDB     #$3C        C2 OUT MANUAL HIGH
C121 F7 E01F            STB     PIACA+PIAAB+1
C124 C6 34              LDB     #$34        C2 OUT MANUAL LOW
C126 F7 E01F            STB     PIACA+PIAAB+1
C129 84 7F              ANDA    #$7F        MASK PARITY
C12B 81 0D              CMPA    #$0D        CR
C12D 27 08              BEQ     OUTPUT
C12F 81 20              CMPA    #$20        SP
C131 25 DB              BLO     NEXT        IGNORE OTHER CONTROLS
C133 81 7F              CMPA    #$7F        DEL
C135 27 D4              BEQ     NEXT        IGNORE DELS
C137 BD CD18    OUTPUT  JSR     OUTP        OUTPUT TO FLEX
C13A 20 CF              BRA     NEXT        GO BACK FOR MORE
                        END     START
```

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***

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***

For Sale TSC Software for 6809. BASIC, EDITOR, and MACRO ASSEMBLER on cassette with manuals $150.00. Don Raitz, 755 W. Nassau Way, Englewood, Co. 80110.(303)781-3458.

***

Commodity Futures Price Data-from March 1976,some earlier data, Date, Open, High, Low, Close, $10.00 for first contract. $5.00 for each additional contract on same order, 5 inch FLEX or JPC. Curtiss Barrett,5713 85th Ave., New Carrollton,Md 20784. Phone (301) 577-2105.

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***

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***

MSI6800 48K,FD-8 Inch Disk, Five Interfaces,Hazeltine 1500, Manuals, Documentation, Disks, Software, etc, $2700. Don Droegemeyer, Rt 12, Box P-132,Ft. Myers,Fl 33908. (813)481-7231.

***

HELP! Has any of your readers Interfaced the Radio Shack Daisy Wheel II Printer to an SWTPC 6800 or 6809 system via the parallel interface card? If so, I would be very much interested in details, both hardware and software. I've been able to hook up the Radio Shack Quick Printer (which uses the 4 inch aluminized paper) without any trouble and only a minor software change, but can't seem to do the same for the Radio Shack Dasly Wheel II. Any help anyone can give me will be greatly appcreciated. The PRINT. SYS. routine supplied by TSC for FLEX 2 does not seem to do the job for this printer, and I lack the expertise in assembly language programming to do the job myself. If anyone out there has aleady solved this problem, please let me know your price for sharing the information with me. Also, because of the good response to an earlier request Thank you, Tony Niesz, 444 Mix Avenue, Hamden, CT 06514.

***

I have a SWTPC 6800 ad a Commandor VIC-20, and I was wondering if you could help me with a hardware problem of connecting a MP-C to the serial port on the VIC, as the VIC doesn't have seperate data in, data out line. Also, I was wondering if you could tell me what difference there are between the MICROCHROMA 68 and the MICROCHROMA II, i.e. is it just a revised product or have any major changes been made? Yours truly, David Speight 701 University Blvd. Apt 158 Mobile, ALA 36688.

6809 Color Computer

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SDS80C Price: $89.95

CRACK THOSE ROMS!

SOURCE GENERATOR: This package is a disassembler which runs on the color computer and enables you to generate your own source listing of the BASIC interpreter ROM. Also included is a documentation package which gives useful ROM entry points, complete memory map, I/O hardware details and more. Disassembler features include cross-referencing of variables and labels; output code which can be reassembled; output to an 80-column printer, small printer or screen; and a data table area specification which defaults to the table boundaries in the interpreter ROM. A 16K system is required for the use of this cassette.

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The monitor has 19 commands in all, and is relocatable and re-entrant.

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MONITOR ROM: The same program as above, supplied in 2716 EPROM. This allows you to use the entire RAM space. And you don't need to re-load the monitor each time you use it. The EPROM plugs into the Extended Basic ROM Socket or a modified ROMPACK.

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VOICE PITCH	- male baritone, variable bass to tenor
DATA RATE	- 4 to 20 BPS, depending upon phoneme
MESSAGE MEMORY	- approx. one byte-per-letter in English
AUDIO OUTPUT	- .2 watt average, 2 watt peak into 8-ohms
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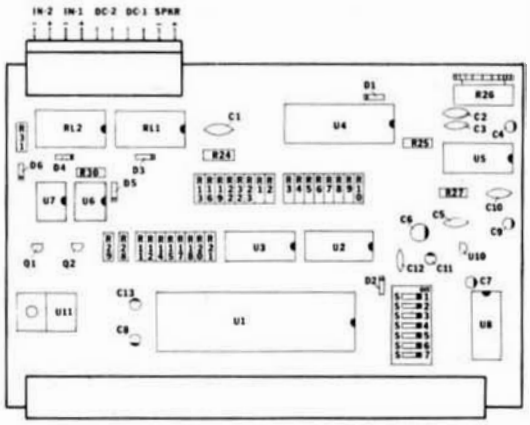
- shipped on 5- or 8-inch disk for single-user TSC or SSB DOS
- 6800 or 6809 code



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VS-1 SPEAKER, manual, program disk .... ~~$220.95~~

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SMOKE SIGNAL: THE UNDISPUTED SUPERSTAR IN 6800 AND 6809-BASED COMPUTER SYSTEMS

Since 1977, we've been designing, developing and manufacturing microcomputers — and associated products — based on Motorola's 6800 and 6809, and configured to the SS-50/SS50C Bus.

The Hardware. All of our boards and complete systems are **Endurance Certified** to completely assure you of the latest in industry-standard and state-of-the-art technology. Our DCB-4 Double Density Controller Board ($449.00) became the Standard Controller Board for the 6800 and 6809, handling up to four 5¼-inch and four 8-inch drives simultaneously. Smoke Signal provides the most innovative solutions for the 6800/6809 SS-50 Bus structure that money can buy.

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Smoke Signal provides Business Application Software to fulfill all vertical needs of the businessperson who is automating.

Our systems software, in conjunction with our DOS, will accomplish any task from text editing and processing up to our Super MACRO-ASSEMBLER that will produce code for every Motorola 6800/6809 family of processors available.

OS-9 Level One and Level Two are the new UNIX**-like Multi-User and Multi-Tasking operating systems that will make the 6809 reach the highest potential. COBOL, FORTRAN, Random File BASIC, Pascal, FORTH and SDBASIC (compiler) are all available for the **CHIEFTAIN.**

*FLEX is a trademark of Technical Systems Consultants.

**UNIX is a trademark of Bell Laboratories.

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Smoke Signal began pioneering research and development on 6800/6809-based computer systems back in 1977. Microware worked three years to perfect OS-9™ and BASIC09.™

Both companies have evolved outstanding 6809-based products from early engineering research, **and both pay almost fanatical attention to detail.** For example . . .

SMOKE SIGNAL'S 6809-based Chieftain™ computer series has **proven** its superiority in hundreds of demanding tasks. From gold-plated connectors to highest-quality materials throughout, each Chieftain™ is built to deliver absolute dependability from day one, and **stay** that way through years of service.

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Thousands of engineers and programmers use MICROWARE software products as their standard time-saving tool . . . to execute process-control applications . . . and for other vital functions. COBOL and PASCAL are also available under the OS-9 operating system.

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In other words, **breathtaking power** with as little as 48k memory; Microware's OS-9 Level Two can access up to one full megabyte that your Chieftain™ can address!

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THERE'S MUCH, MUCH MORE! Call or write SMOKE SIGNAL for details on Chieftain™ computers and MICROWARE software.

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32K S-100 EPROM CARD
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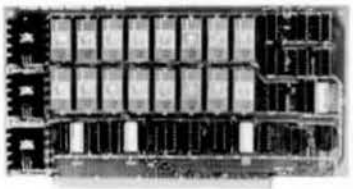


$79.95 KIT

USES 2716's

Blank PC Board - $34

ASSEMBLED & TESTED ADD $30

SPECIAL: 2716 EPROM's (450 NS) Are $9.95 Ea. With Above Kit.

KIT FEATURES:
1. Uses +5V only 2716 (2K x 8) EPROM's
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible.
4. Addressable as two independent 16K blocks.
5. Cromemco extended or Northstar bank select.
6. On board wait state circuitry if needed.
7. Any or all EPROM locations can be disabled.
8. Double sided PC board, solder-masked, silk-screened.
9. Gold plated contact fingers.
10. Unselected EPROM's automatically powered down for low power.
11. Fully buffered and bypassed.
12. Easy and quick to assemble.

32K SS-50 RAM

$299.00 KIT

For 2MHZ Add $10

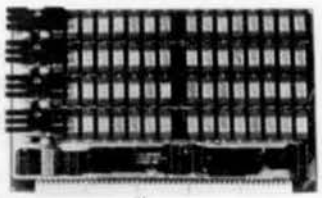
Blank PC Board $50

For SWTPC 6800 - 6809 Buss

Support IC's and Caps $19.95

Complete Socket Set $21.00

Fully Assembled, Tested, Burned In Add $30



At Last! An affordable 32K Static RAM with full 6809 Capability.

FEATURES:
1. Uses proven low power 2114 Static RAMS.
2. Supports SS50C - EXTENDED ADDRESSING.
3. All parts and sockets included.
4. Dip Switch address select as a 32K block.
5. Extended addressing can be disabled.
6. Works with all existing 6800 SS50 systems.
7. Fully bypassed. PC Board is double sided, plated thru, with silk screen.

16K STATIC RAM KIT-S 100 BUSS

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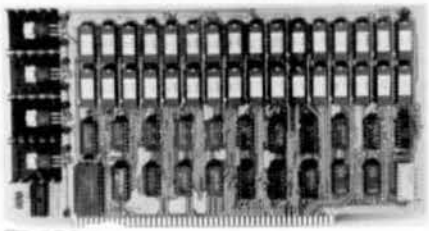
$169.95 KIT

FOR 4MHZ ADD $10



KIT FEATURES
1. Addressable as four seperate 4K Blocks.
2. ON BOARD BANK SELECT circuitry. (Cromemco Standard). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 1.5 Amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA- $3

LOW PROFILE SOCKET SET-$12

SUPPORT IC'S & CAPS-$19.9

ASSEMBLED & TESTED-ADD $35

OUR #1 SELLING RAM BOARD!

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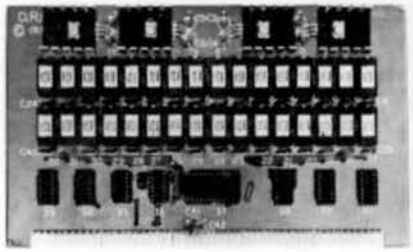
PRICE CUT!

$159 KIT

FULLY STATIC!

FOR 2MHZ ADD $10



FOR SWTPC 6800 BUSS!

ASSEMBLED AND TESTED - $35

KIT FEATURES
1. Addressable on 16K Boundaries.
2. Uses 2114 Static Ram.
3. Fully Bypassed.
4. Double sided PC Board. Solder mask and silk screened layout.
5. All Parts and Sockets included.
6. Low Power: Under 1.5 Amps Typical.

BLANK PC BOARD—$35 COMPLETE SOCKET SET—$12
SUPPORT IC'S AND CAPS—$19.95

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S-100 SOUND COMPUTER BOARD

At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

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- PC BOARD IS SOLDERMASKED, SILK SCREENED, WITH GOLD CONTACTS.
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Both Basic and Assembly Language Programming examples are included.

COMPLETE KIT! **$84.95** (WITH DATA MANUAL)

BLANK PC BOARD W/DATA $31

SOFTWARE:

SCL™ is now available! Our Sound Command Language makes writing Sound Effects programs a SNAP! SCL™ also includes routines for Register-Examine-Modify, Memory-Examine-Modify, and Play-Memory. SCL™ is available on CP/M* compatible diskette or 2708 or 2716 Diskette - $24.95 2708 - $19.95 2716 - $29.95. Diskette includes the source. EPROM'S are ORG'd at E000H. **(Diskette is 8 Inch Soft Sectored)**

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TR1602B — SAME AS TMS6011, AY5-1013, ETC. 40 PIN DIP

TR1602B

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National Semi. MM5257. Arranged 4K x 1, +5V, 18 PIN DIP. A Lower Power, Plug in Replacement for TMS 4044, 450 NS. Several Boards on the Market Will Accept These Rams. SUPER SURPLUS PURCHASE! PRIME NEW UNITS!

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AY3-8910. As featured in July, 1979 BYTE! A fantastically powerful Sound & Music Generator. Perfect for use with any 8 Bit Microprocessor. Contains: 3 Tone Channels, Noise Generator, 3 Channels of Amplitude Control, 16 bit Envelope Period Control, 2-8 Bit Parallel I/O, 3 D to A Converters, plus much more! All in one 40 Pin DIP. Super easy interface to the S-100 or other busses. **$11.95** **PRICE CUT!**

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Software Dynamics has been offering quality software for 68xx class machines since 1977. We recognize that our customer's needs grow, and design our software to provide a growth path. SD offers compatible single-user, multi-user, and (soon) network systems to meet this need. Programs that run on the single-user system run unmodified on the multi-user and network systems. A virtual terminal driver assures that screen-oriented applications run on any CRT.

The BASIC compiler is the result of 10 years experience in building BASIC interpreters and compilers. Sequential, random and indexed files are supported, along with true BCD numbers to eliminate conversion errors. Long variable names, blocks for structured programming, and true multi-parameter subroutines and string functions aid program construction and maintenance. Compiled programs are both small and very fast, and the source is completely protected.

SD also offers word processing and accounting software built to the same high standards as its system software.

SDOS™

- Interrupt-driven DOS
- Read-ahead on sequential files
- LRU buffering optimizes random files
- Byte-addressable, device independent files
- Virtual terminal driver handles any CRT
- Command files
- Keyboard typeahead
- Disk file structure validation program
- Adaptable to any 68xx micro with 40kb or more
- Any combination of floppies or hard disk

SDOS/MT™

- Multi-user version of SDOS
- 1 to 8 users
- User space to 60 kilobytes
- Any hardware mapping technology

Structured Design BASIC V1.4

- 32 character variable names
- Line labels
- Parameterized, multi-line functions and subroutines
- Full access to SDOS sequential and random file facilities
- Multi-key indexed file option
- Print using with floating dollar sign
- 10 digit fast decimal floating point (no conversion errors!)
- Binary integer arithmetic
- IF-THEN-ELSE, WHILE-DO, ON ERROR DO
- Many other block structure facilities
- COMMON and program chaining
- Super fast execution
- Very compact compiled code
- Complete error trapping

SDOS is available for the following hardware:

Midwest Scientific Instruments 6800
Pace Technology 480
WaveMate Series 2000
Omnibyte 800, 890
Brittania Computing Models 242, 363, 484, 1010
Motorola Exorcisor™

SEDIT

- What-you-see-is-what-you-get editor
- Uses cursor and arrow keys for positioning
- Insert by typing at cursor location
- Delete by RUBOUT at cursor location
- Edit any size file
- Cut and paste to move text
- Automatic margin wrap
- Tabs
- Very easy to learn

TYPE

- Word or document processing
- Letter and envelope generation
- Form letters with mailing lists
- Complete margin justification
- Centering and underscoring
- Table of contents generation

COUNT/UP

- Full accounting package
- General Ledger, Accounts Receivable, Accounts Payable
- User specifies all report formats
- Account structure and formats changeable at any time

Other programs:

SORT	Sorts records according to any combination of key fields
EDIT	Powerful context editor
IDB	ROMable debugger with single step capabilities
MEMTEST	Thorough memory diagnostic
ASM	6800/6809 assemblers
CHESS	For lighter moments

6809 versions should be available in October, 1981.
BASIC 1.3, ASM and EDIT are available for 6800 FLEX™, SSB DOS or MDOS™.
SD also offers both 5¼" and 8" Winchester disk drives for Exorcisor systems.

Write for free catalog.

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Two NEW quality software products for 6800 and 6809 users .....

COPYCAT

lucidata

The COPYCAT utilities are a set of tools designed to overcome the incompatibilites between different disk operating systems. The utilities, written in assembler, are supplied in source form on a standard FLEX format disk. They provide a range of capabilities: DIRectories can be listed from TSC's miniFLEX, Smoke Signal Broadcasting's DOS68 and Digital Research's CP/M (yes THE CP/M) Files can also be copied from those disks, by name, to regular FLEX format files. Additional utilities are provided to convert compressed text files and to analyse "difficult" disk structures. The package includes an informative User Manual which contains advice on adapting the package.

COPYCAT2 (6800) on 5" FLEX 2 disk $50, on 8" disk $65
COPYCAT9 (6809) on 5" FLEX 9 disk $50, on 8" disk $65

JUST THINK OF ALL THAT CP/M SOFTWARE NOW ACCESSIBLE !!!!

TEKPAK

lucidata

The TEKPAK graphics package supports all the basic functions of the TEKTRONIX 40xx series of terminals (and those that emulate them). It is written in standard Pascal with the exception of an EXTERNAL call to an assembler module. This module is an interrupt driven CIO buffer driver which interfaces to the LUCIDATA Pascal Run-time system. The graphics library contains procedures for terminal control, screen level (INTEGER) graphics, and virtual level (REAL) graphics including windowing and clipping. TEKPAK is supplied in source form on a standard FLEX format disk.

TEKPAK2 (6800) on 5" FLEX 2 disk $100, on 8" disk $115
TEKPAK9 (6809) on 5" FLEX 9 disk $100, on 8" disk $115

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Full feature 10K BASIC with 9 digit floating point, string functions and math functions. 6809 version only. Disk version available soon.

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8080 simulator for 6800 & 6809 processors.

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Command file processor with parameter substitution for FLEX™ 6800 and 6809 versions.

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Allows for commands to function effectively on a single disk FLEX™ system. 6800 & 6809 versions.

MOVE $14.95
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Add $1.00 Shipping in USA, $5.00 elsewhere.
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Disk (Percom or FLEX™)

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Software available for F-8, 6800, 8085, 8080, Z-80, 6502, 1802, 2650, 6809 based systems.

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PM-3	TMS 2716	17.00
PM-4	TMS 2532	33.00
PM-5	TMS 251 . 2716, 2758	17.00
PM-8	MCM68764	35.00

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- Optional allocation of variables to absolute memory locations allows easy control of memory-mapped peripherals (eg video boards, PIA's ACIA's etc)
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- Fast, easy-to-use compiler generates ultra efficient position independent and ROMable P-code instructions
- Multiple files - may be sequential/random disk files supported by your DOS, or physical devices added by you
- Scalar I/O to READ and WRITE your own SCALAR TYPES
- Custom versions available to special requirements
- All LUCIDATA Pascals are supplied with a comPrehensive User Manual PLUS lots of demo programs and are fully supported by our Update Service

6800 FLEX 2 version on 5" disk $150, on 8" disk $165
6809 FLEX 9 version on 5" disk $190, on 8" disk $205
User Manual separately $25 (deductable from purchase)
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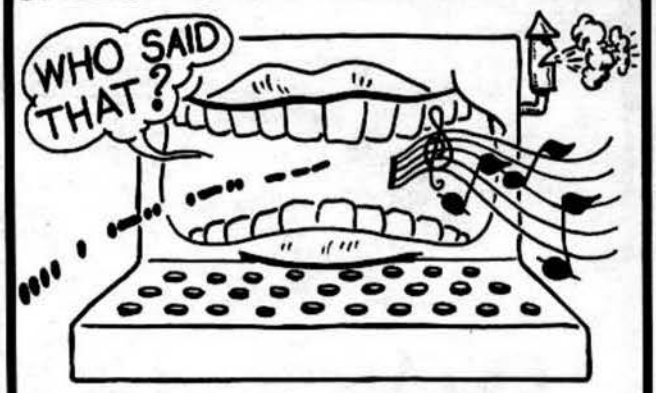
SPEECH SYSTEMS ANNOUNCES



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Versatility Phoneme Speech to create any word.
plus Music
Sound Effects
Exact Waveform Speech
Even simultaneous Speech and Music

Applications Security Systems
Automatic Telephone Answer/Originate
Teaching Machine
Games
Touch-Tone Synthesizer
and much more.

Important Features

● FIFO Buffer	Frees computer for other tasks.
● Speech Editor	Helps compose words.
● 800+ Word Vocabulary	Preformed words, ready to use.
● Music Interpreter	C#1K = the note C sharp, first octave, half note.
● 60 Page Manual	Clearly explains the synthesis of Speech, Music, and Sound Effects.
● Two Ouput Lines	Allow control of external devices (e.g. telephone)
● Speech Inflections	4 programmable inflections plus 64 programmable speeds.
● Interface	Standard SS-30 p.c. board uses 1 I/O port.
● Power Amplifier	On board audio amplifier easily drives external speaker.
● Software	An entire disk of speech, music, and sound effects written in both BASIC and assembly language.
● Portability	Software available on 5" disk for FLEX 2.0 or FLEX 9.0
● Compatibility	Owners of Newtech's Model 68 Music Board may replace the 68 with the SS-1 while keeping total compatibility with your existing Music and Sounds Effects software at the same time gaining Speech capabilities.

The Good News

SS-1 Assembled, Tested, Manual, Disk	$219.95
SA-1 As above without SC-01 speech synthesizer chip (Allows Alford & Assoc. VS-1 owners to upgrade)	$139.95
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UP-1 Three chip set to upgrade MS-1 to SS-1	$109.95
SP-1 Additional Software (Games, Sound Effects, Music)	$29.95

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SMOOTH™ Software

Modem Program with Disk File Transfer (Instructions and Source Listing)	$30.00
Super Modem Program (Manual with Instructions and Source Listing)	50.00
Disk with source and object code	add 10.00
Specify Regular or Super, 6800 or 6809, SSB or FLEX™, 5" or 8"	
ALL IN ONE	for only $45.00
Editor - Text Processor - Mailing Labels	
Mailing Lists - Use any CRT terminal and printer	

Supports Editing commands such as bottom, change, delete, find, insert (single line), input (multiple lines), list, next, overlay (with cursor editing, character deletion and insertion), overstrike (for selected darker text), print, restart, set, top, underline, up, and verify.

Supports Text Processing commands such as block copy, block move, centering, margin justification (wide and narrow), paging, and tabbing.

Mailing Lists and Labels. Use the same mailing list disk file (with protected areas) for both mailing labels and repeat letters. Repeat letters are personally adressed to each person or selected persons on the mailing list.

Most Powerful File Handler found in any editor. Append one file to the end of another, or insert (merge) one file into another as designated by the line pointer. Print specified lines to your printer or to a disk file. Edit files larger than the text buffer. Does not produce output files when not desired. Delete disk files from the editor.

Printer commands. Control characters can be sent to the printer for format control either directly from the control terminal or by imbedding them in the text. The set command contains interface initialization and character output routines to support the SWTPC MP-C interface as well as the standard serial and parallel interfaces. Jumps are also provided to user supplied printer routines. User selects the port address (0 thru 7, A or B) thereby eliminating the need for the user to install printer software routines. Editor can be initialized for either 4 or 16 addresses per port.

Editor allows exiting to either the monitor or DOS and then reenter (Warm Start) without destroying previously prepared text in the buffer. The Restart command erases contents in the buffer without the user having to reload the Editor.

The Editor allows the user to toggle between full duplex (no echo) and half duplex (echo) as needed. It responds to commands in both upper and lower case and can be used to create assembler source code and Basic programs as well as text.

Specify 6800 or 6809, SSB or FLEX™, 5" or 8"	45.00
Printed source listing is available for an additional	35.00

Software by Technical Systems Consultants, Inc.

Flex™ (includes Editor and Assembler)	150.00
UniFLEX™ (includes one year maintenance and update)	550.00
Editor	50.00
Assembler	50.00
6809 Cross Assembler on 6800	100.00
68000 Cross Assembler on 6809	250.00
Text Processor	75.00
Basic	75.00
Extended Basic	100.00
Basic Precompiler (specify standard or extended)	50.00
Multi-User Basic for S/09	150.00
Pascal (Flex™)	200.00
Pascal (UniFLEX™)***	225.00
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6800 Flex™ Utilities	100.00
6809 Flex™ Utilities	75.00
Debug Package	75.00
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The following are available for 6800 only	
Soap (stack oriented arithmetic processor)	25.00
Floating Point Package	25.00
Scientific Functions Package	25.00

Software by Microware Systems Corp.

OS-9™ Level One Operating System**	195.00
OS-9™ Level Two operating System	495.00
BASIC09***	195.00
**Yearly Maintenance and Update	add $75.00
OS-9™ Text Editor	95.00
OS-9™ Interactive Assembler	95.00
OS-9™ Interactive Debugger (Disk version)	35.00
RT/68 Real Time Operating System (6830 or 2708)	75.00
Specify manufacturer and type of CPU and I/O controller	
ABASIC on cassette (Limited quantity)	Phone for special price

SWTPC	Kit	Assembled
All Bareboards (sorry)	N/A	N/A
8209 9" Intelligent Terminal	N/A	1075.00
8212 12" Intelligent Terminal	N/A	1145.00
8212W 8212 with word processing enhancements	N/A	1250.00
DC-1 or DC-2 5" Disk controller (limited quantity)	N/A	125.00
CT-64 Terminal kit (limited quantity)	325.00	450.00
DMF-2 8" DMA double density, double sided controller board	N/A	595.00
MP-A CPU Board	N/A	5.00
MP-A2 CPU BOARD	N/A	150.00
MUB-68 Multi-User Board with Multi-User Basic	N/A	150.00
68/1 Computer	315.00	315.00
4K RAM Board	70.00	65.00
MP-S Serial interface (single port)	40.00	60.00
MP-S2 Serial interface (dual port)	N/A	120.00
MP-LA Parallel interface (dual port)	40.00	60.00
MP-L2 Parallel interface (dual port)	N/A	120.00
MP-R Single voltage 2716 prom programmer	N/A	114.50
MP-N calculator board	54.95	92.00
MP-T Interrupt timer	47.50	92.00
MP-8M 8K 4044 Memory board (limited quantity of kits)	180.00	275.00
S32 Universal Static Memory Board	N/A	124.50
S3216 Universal Static Memory Board with 16K Ram	N/A	375.00
S3232 Universal Static Memory Board with 32K Ram	N/A	575.00
MP-09 6809 CPU board kit (assembled board has sockets)	195.00	250.00
69 Chassis, P.S., 2MHz 6809 CPU, 8K, RAM, One Serial Port	575.00	799.00
S 00 Chassis, Power Supply I/O (no processor or memory)	N/A	799.00

6800 CPU and Disk Controller Boards

Due to the relative unavailability of these SWTPC items, please refer to the next column for ELEKTRA and GIMIX alternatives. Phone to SWTPC availability.

Universal 68XX Motherboard. SS-50/50C. 4/16 addresses per port	80.00
Connectors (10 pin, Titanium-Tin plated 5 microns for near gold quality)	
Male with square cross section pins	each .50
Female	each .75

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OS-9 and BASIC09 are trademarks of Microware Systems Corp.
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ELEKTRA™ SS50 Computer Products

DPSb Duel Port Serial Interface bare board and documentation	20.00
DPPb Dual Port Parallel Interface bare board and documentation	20.00
MBb Motherboard bareboard and documentation	N/A
CPU-8/9b 6808-6809 CPU bare board and documentation (6808 is 6800 software compatible)	50.00
HUMBUG (from STAR-KITS) for CPU-8/9 board	
2K version for 6800 (6808)	40.00
HUMBUG-09 for 6809	75.00
Other HUMBUG versions including video versions are available. (Specify system)	
Cabinet (heavy gauge, 2 cutouts for 5 1/4" disk drives, drive mount, line cord, line fuse, power switch, reset switch, 70 cfm fan, EMI filter, 8 RS-232 cutouts) and power supply (20a 8v, 4a 16v, 4a -16v), use any current SS-50 or SS-50C motherboard	395.00
Cabinet without power supply	250.00
Power supply (20a 8v, 4a 16v, 4a -16v)	175.00
5" disk regulator board	25.00
Filler plate for 5-1/4" cutout	10.00

MPI S 1/4" DISK DRIVES with 30 day guarantee and 5 msec stepping rate

Our service department thoroughly tests every MPI drive before we ship.

B51 - Single head, single or double density capability, 40 tracks	$250.00
B52 - Double head, single or double density capability, 40 X 2 tracks	335.00
B91 - Single head, single or double density capability, 80 tracks	335.00
B92 - Double head, single or double density capability, 80 X 2 tracks	470.00
MPI - Service Manual	20.00
Dual drive cabinet for 5 1/4" drives with power supply, line cord, fuse, power switch, and power cables to drives	125.00
***Dynamite* Disassembler**	60.00
SUPER SLEUTH Disassembler System	99.00
Microtime 6800 Calender and Clock Board (assembled and tested)	105.00
Bareboard, connector, and documentation only of above	35.00
(See review Feb 1980 '68' Micro Journal)	
Epson Printer (Centronics compatible parallel interface)	495.00
(with Serial RS-232 interface option)	add 75.00
Spare Print Head	30.00
Spare ribbon cartridge	15.00
Optimal Technology, Inc. EP-2A-79 Eprom Programmer	169.00
PM-0, PM-1, PM-5, PM-6, PM-7 Personality Modules	each 18.00
PM-2, PM-4	each 34.00
PM-3	28.00
PM-8	36.00
GIMIX (The Ultimate)	
6800 CPU Board	224.03
with timers	288.06
with baud rate option	add 30.00
with 2MHz option	add 15.00
2 MHz 6809 Plus CPU, time of day clock, battery backup, 1K NMOS RAM	578.05
CMOS RAM substitution	8.00
GIMIX Dynamic Address Translator	35.00
SWPTC compatible DAT	15.00
9511A Arithmetic Processor (4MHz)	312.00
9512 Arithmetic Processor (3MHz)	265.00
GMXBUG-09 (Terminal Based) 1K scratchpad required	98.85
Bootstrap Prom	30.00
Video Prom (includes bootstrap)	30.00
Manual and Source Listing only	38.62
Missing cycle detect card	38.23
Disk Controllers (All have data separators and can be used with either single or double headed drives)	
5" single density controller without 1771 chip	158.38
8" single density controller complete	198.48
5" and 8" single density controller complete	226.58
5" double density controller with variable precomp	348.28
DMA 5" AND 8" double density controller with variable precomp	548.68
GIMIX version of FLEX™ (without Editor and Assembler)	90.00
Double disk regulator card	68.22
Ribbon cable for two 5 1/4" disk drives (short)	34.98
Ribbon cable for two 5 1/4" disk drives (long)	39.96
Ribbon cable for two 8" disk drives (long)	44.28
Memory	
32K Static RAM Board with 16K of RAM installed	298.12
32K Static RAM Board with 24K of RAM installed	348.14
32K Static RAM Board with 32K of RAM installed	398.15
64K Static RAM Board with 56K of RAM installed	994.58
64K Static RAM Board with 64K of RAM installed	1088.64
16 Socket EPROM/ROM/RAM Board	238.32
8K Promboard (2708)	98.34
4K PPD 4K Prom Board and 2708 Prom Burner	198.00
I/O Boards	
Single port 30 pin serial interface (Requires 1 cable set)	88.41
Dual port 30 pin serial interface (Requires 2 cable sets)	128.43
8 port 50 pin serial interface with baud rate generator	318.46
Dual port 30 pin parallel interface (Requires 2 cable sets)	88.42
8 port 50 pin parallel interface with interrupt generator	198.45
cable sets for above boards (specify board)	22.95
Video Boards	
64 or 32 X 16	198.71
80 X 24 without RAM character generator	398.74
80 X 24 with RAM character generator	458.76
High resolution (512 X 512 dot resolution)	996.77
2MHz 6809 PLUS Computer System with 56K Memory	2498.29
Mainframe (Chassis, PS, Switches, Fan, Motherboard, Baud Rate Gen.)	998.19

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SEE GIMIX AD PAGES 3 & 56

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If you need M68000, Z8000, or 8086 Software, take it off our shelf.

Why wait up to 6 months for high quality 16-bit resident system software, when you can get it now?

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THOMAS INSTRUMENTATION

THE MACHINE TOOL, INDUSTRIAL SPECIALISTS IN BUSINESS ON A FULL TIME BASIS FOR 10 YEARS

NEW PRODUCT: **S-R/R**

48K 2MHz STATIC RAM/ROM CARD

- *24 2K blocks memory mapped on any 2K boundary
- *uses low power 2016P-2 (2128) RAM and/or 2716 ROM
- *mix 4K blocks of RAM and ROM
- *6800 and 6809 compatible
- *use on SS-50 and SS-50C buss
- *decoded for extended addressing
- *5 volts only
- *low power consumption (typ. ½ amp with 48K RAM)
- *gold connectors

Bare Board $49.00 2716 1MHZ $9.95 2016 P-2 2MHZ $16.50

A/T with 16K $250.00; with 32K $375.00; with 48K $495.00

A/T without memory chips $120.00

NEW ACCESSORIES FOR 68XX USERS:

SS-50/SS-50C EXTENDER CARD	$35.00
SS-30 EXTENDER CARD	$25.00
*Both cards assembled with a built in logic aid & gold edge connectors	
SS-30 WIRE-WRAP/PROTOTYPE BOARD (board only)	$20.00
*Pad spacing permits most standard sockets from 8 to 64 pins	
*Provision has been made for voltage regulators	

FEATURED PRODUCT: **SP-1 Bare card $49.00 Asm. + tested $195.00**

*A super prototype board *Card design includes

(3) 6821 6 parallel ports
(4) 6850 4 serial ports
(1) 6840 3 16 bit counter/timers

which are fully buffered and decoded

*Accomodates a mix of 38, 14 & 16 pin wire wrap sockets

*Pad spacing permits most standard sockets from 8 to 64 pins

MODEM CARD	B/C	$ 49.00
special parts kit		$195.00
A/T without extra features		$325.00
*SUPER CPU assembled with source listing without 2K EPROMS (2-2708)		$235.00
*Monitor in two 2708 EPROMS		$ 29.00
*CPU bare card, doc., & src.		$ 59.00
*VIDEO RAM asm. 7x9 chars 64x16		$195.00
*VIDEO RAM bare, doc. Xtal. src.		$ 49.00
*PARRALLEL I/O asm 100 I/O lines incl. 5 PIA's for 10 ports		$139.00
*PARALLEL I/O bare card & doc.		$ 49.00
*SS-50 WIRE-WRAP/PROTOTYPE bare		$ 39.00
*TRANSITION CARD asm.		$ 95.00
*TRANSITION CARD bare		$ 49.00

A/T with extra features	$395.00
Software obj. & src. on FLEX disk	$ 10.00
BACKPLANES AND MOTHERBOARDS	
*16 position SS-50	$80.00
*12 position SS-50	$60.00
* 8 position SS-50	$40.00
* 6 position SS-50	$30.00
* 4 position SS-50	$20.00
* 8 position SS-30	$39.00

**Connectors:
GOLD $1.60 ea. (M or F)
TIN M $.40 ea. F $.50 ea.

DEALERS FOR SWTPC, GIMIX, AND TSC

*All Thomas Instrumentation's cards come with full documentation including software source listings where applicable *All assembled cards are burned in at 150F and fully tested with Gold conn. *Bare card prices do not include edge connectors *See previous ads, write, or call for more detailed information.

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To satisfy in-depth questions regarding our products send $20.00 to receive full documentation, schematics, & source listings for all boards currently in production

64K BYTE CMOS STATIC RAM BOARD . . . with Battery Back-Up

Using the latest in memory technology, the GIMIX 64K BYTE CMOS STATIC RAM BOARD combines the best features of previous memory boards on one board.

FULLY STATIC MEMORY with its inherent low soft error rate and freedom from alpha-particle induced errors. No complicated refresh timing or clocks required for data retention. Fully compatible with any of the 6800/6809 DMA techniques.

HIGH SPEED 200ns. memorys for guaranteed operation at 2MHz. with no wait states or clock stretching required.

ULTRA-LOW POWER CMOS RAM requires less than 1/4 AMP (250 Ma.) at 8V. for a fully populated 64K BYTE board. Less power supply loading and heat generation for cool, efficient operation.

NON-VOLATILE using an on-board nickel-cadmium battery. The board retains data even with system power removed. With the battery fully charged, the contents of the memory remain intact for a minimum of 21 days.

HIGH DENSITY permits greater memory expansion to meet the needs of todays sophisticated, multi-user/multi-tasking operating systems.

ADDRESSABLE in two 32K sections that have their own decoding for both the regular and extended (SS-50C) address lines. Each section can be addressed to any 32K boundary in the address range (1M BYTE with extended addressing). The 32K sections are divided into four 8K blocks that can be individually enabled or disabled. Disabled sections do not occupy any address space.

RELIABLE like all GIMIX products, the 64K BYTE CMOS STATIC RAM is designed with reliability in mind. Series damping resistors, a fully gridded power and ground layout, and generous power supply decoupling, all contribute to reliability and data integrity. An unsafe voltage detect circuit inhibits writes to the board, when the 8V. supply falls below a preset level, to prevent loss of data during the transition between system and battery power.

The GIMIX 64K BYTE STATIC RAM BOARD is ideally suited to a wide variety of applications.

Its high density and ultra-low power consumption make it possible to greatly expand systems with a few available bus slots and limited power supply capabilities.

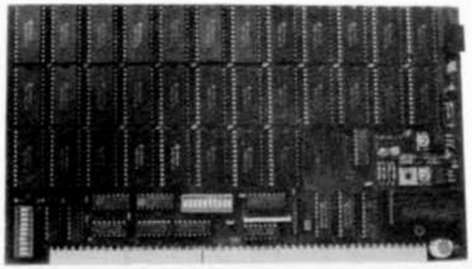
The battery back-up feature is useful where data loss due to power failure cannot be tolerated, or as a replacement for disk or tape storage where conditions such as environment prohibit their use. Since the entire board can be hardware write protected by a switch located at the top of the board, it can also be used to emulate PROM or ROM memory. This is especially useful during firmware developement where frequent software changes must be made.

When the board is used in conjunction with a device such as the GIMIX MISSING CYCLE DETECTOR BOARD, which monitors the A.C. line and generates an interrupt when a power failure occurs, critical data can be stored and system integrity maintained during either expected or unexpected power outages.

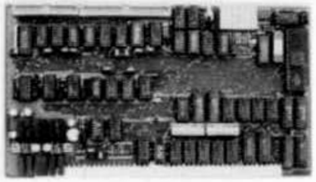
The **GIMIX 64K BYTE STATIC MEMORY BOARD** is available in 56K and 64K versions. Both version include all of the above features: gold bus connectors; and come fully assembled, burned in, and tested.

56K version **$ 994.56**
(Socketed for 64K)

64K version **$1088.64**



GIMIX KNOCKS OUT DISK PROBLEMS



GIMIX DMA DOUBLE DENSITY DISK CONTROLLER #68

The GIMIX DMA (Direct Memory Access) DISK CONTROLLER has the capabilities needed to realize the full potential of todays sophisticated multi-user/multi-tasking operating systems such as OS-9™ and UniFLEX™.

HIGH SPEED using bi-polar logic DMA circuitry for guaranteed operation at 2MHz. DMA transfers take place at full bus speed using 6809 cycle steal DMA. Once the required parameters are passed to the controller and DMA transfer is initiated the processor is free for other tasks. Interrupts can be generated to indicate the completion of the transfer.

SINGLE AND DOUBLE DENSITY data storage on any combination of 5¼" and 8" floppy disk drives, single and double headed, single and double track density, up to 4 drives total.

LOW ERROR RATES are insured by a phase lock data recovery circuit (data separator) and adjustable write precompensation circuitry for drives that require precomp. Separate precomp adjustments are provided for 5¼" and 8" drives.

ADDRESSABLE to any 8 byte boundary in the address space (1M byte when extended address decoding is used). The board occupies only 8 bytes of address space.

EXTENDED ADDRESSING control using the SS-50C extended address lines. Control of the extended address lines allows the board to perform DMA transfers to and from any address in the 1M byte address space.

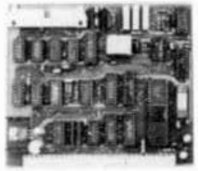
FULLY BUFFERED with separate 5¼" and 8" output buffers and schmidt trigger input buffers for the disk drive signals.

The DMA controller leaves the processor free to perform other tasks once the transfer is initiated, unlike programmed I/O disk controllers which require full time use of the processor during data transfers to and from disk.

This is extremely important in a multi-user/multi-tasking environment as the processor can perform other tasks such as console I/O while a disk transfer is in progress.

#68 fully assembled, burned in, and tested **$548.68**

GIMIX DOUBLE DENSITY PIO DISK CONTROLLER #28



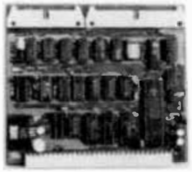
The GIMIX DOUBLE DENSITY PIO (PROGRAMMED I/O) DISK CONTROLLER is a versatile floppy disk interface for use in 6800 systems on the SS-50 or SS-50C bus. The board physically occupies one slot of the 30 pin I/O bus.

- Double the unformatted storage capacity of single density controllers
- Single and double density operation
- Phase lock data recovery circuit (data separator)
- Adjustable write precompensation (precomp)
- Controls up to four 5¼" drives
- Controls single and double headed drives
- Designed to meet the data hold-time requirements of the Western Digital 1797 floppy disk controller I.C.

The GIMIX DOUBLE DENSITY PIO DISK CONTROLLER is ideal for systems that require greater data storage than that provided by single density controllers, without increasing the number or type of drives. In most cases existing 6809 systems can be upgraded by adding only the controller and the appropriate operating system software.

#28 fully assembled, burned in and tested **$348.28**

GIMIX 5/8 DISK CONTROLLER BOARD #58



The GIMIX 5/8 DISK CONTROLLER is a versatile floppy disk interface for use with both 6800 and 6809 systems on the SS-50 or SS-50C bus. The board physically occupies one slot of the 30 pin I/O bus.

- Hardware and software compatible with existing disk controllers (SWTPc DC-1, DC-2 and DC-3)
- Controls up to four 5¼" drives in 6800 systems
- Controls any mix of 5¼" and 8" drives, up to four drives total, in 6809 systems
- Provides for double headed drives
- Synchronous data separator for data reliability
- Designed to meet the data hold-time requirements of the 1771 floppy disk controller I.C.

The GIMIX 5/8 DISK CONTROLLER is ideal for a variety of [illegible]

#58 fully assembled, burned in, and tested **$228.58**

NOTE: When ordering disk controllers please specify the make and model of the drives being used.

GIMIX 6809 FLEX™

GIMIX™ versions of TECHNICAL SYSTEMS CONSULTANTS' 6809 FLEX™ specify controller and type of drive: 8"; or 5¼" 40 track (48TPI) or 80 track (96TPI) **$90.00**

GIMIX versions of Technical Systems Consultants 6809 FLEX™ operating system are available for all three GIMIX disk controllers. They fully support all the features of each controller and are software compatible with other versions of FLEX™. GIMIX FLEX™ includes a disk FORMAT program that allows the user to pick the number of tracks to format, single or double sided disks, and where appropriate single or double density. GIMIX FLEX™ supports single and double track density (48 and 96 TPI) 5¼" drives and allows 96 TPI (80 track) drives to read, write, or format 48 TPI (35 or 40 track) disks.

MICROWARE's OS-9™ level 1 for GIMIX™ SYSTEMS specify controller and type of drive: 8"; or 5¼" 40 TRACK (48TPI) or 80 track (96TPI) $195.00

TECHNICAL SYSTEMS CONSULTANTS' UniFLEX™ is also available

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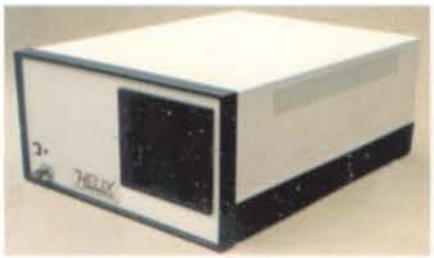
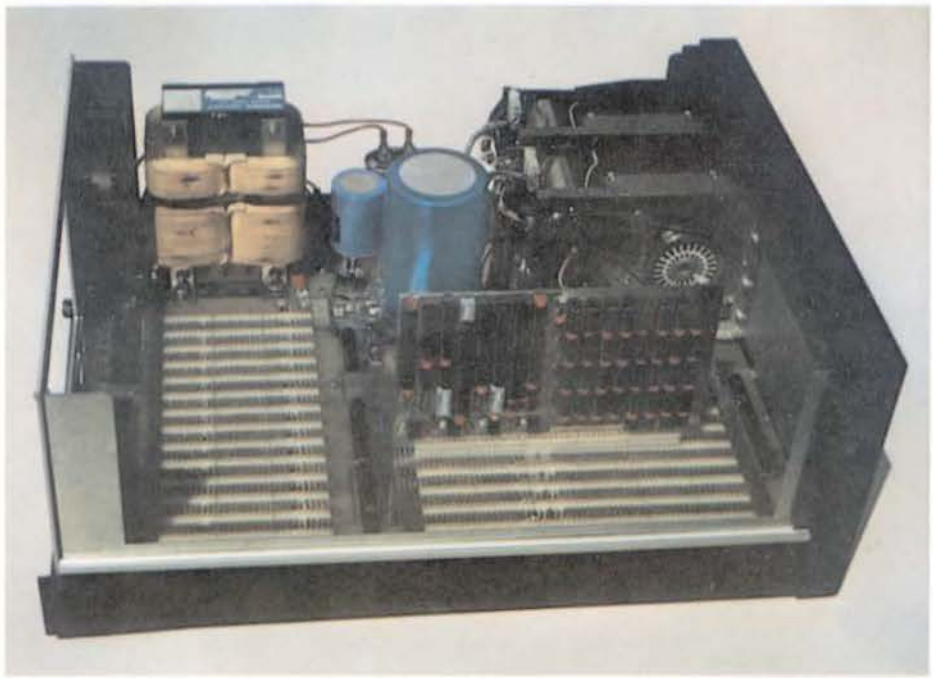
CHICAGO, ILLINOIS 60609
(312) 927-5510 • TWX 910-221-4055

HELIX™





THE MAINFRAME

- Industry Standard Optima™ Cabinet
- Largest Constant Voltage Power Supply in the industry
- S-64 Bus gives 16 Bit Power and S-50 Bus Compatibility
- 10 Main (S-64) Slots
- 14 I/O (S-30) Slots plus 2 On-board
- On-board Baud Rate Generator to 38.4Kb
- Space and Power for two 5¼" Disk Drives
- Full Address Decoding for I/O Slots
- Two RS-232 Serial and Two parallel Ports On-board
- Single Board Construction for Reliability
- Faraday Shielded Bus Lines give "Text Book Clean" Signals

THE PROCESSORS

6809

- Standard 2 MHz Operation
- Standard DAT Compatible with GIMIX and SWTPC
- Standard 6840 Interval Timer
- Standard 1K Scratchpad RAM
- Standard Clock/Calendar with Battery
- Provision for Programmers Console

68000

- Standard 8 MHz Operation
- Memory Management Hardware
- Provision for Programmers Console
- 16 Bit Power and 8 Bit Compatibility

The HELIX™ computer system represents the latest advance in S-50 bus computer systems. Relying on the physical nature of S-50 bus connectors to guarantee compatibility, the HELIX adds 14 bus lines (becoming S-64) to allow a 68000 processor to operate with full 16 bit data transfer and 24 bit addressing, while at the same time providing full interchangability with existing S-50 components.

Offered with a selection of processors, memories, and peripheral controllers, a HELIX system can be configured for applications ranging from advanced hobbyist to multiterminal time-sharing.

Designed to offer the utmost in speed, reliability, and utility at a reasonable price, it represents a new standard of quality for those who require a professionally designed computer for professional use.

THE POWER SUPPLY

- Ferro-resonant Transformer for Line Noise and Under-Voltage Protection
- Conservative 25 Amps at 8.5 Volts
- Conservative 5 Amps at ±16 Volts
- Conservative Component Rating for Reliability

THE COMPONENTS

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